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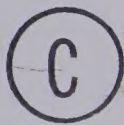
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LIMITATIONS OF THE USE OF OPTICALLY SCORED TEST
ANSWER SHEETS

BY



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A THESIS

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The undersigned certify that they have read,
and recommend to the Faculty of Graduate Studies for
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Optically Scored Test Answer Sheets" submitted by
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DEDICATION

TO PENNY

ABSTRACT

By testing a sample of 1624 Alberta school children from the Edmonton Separate and the Stettler school districts, the author examined the practical limitations of the use of an optically scored test answer sheet. The experimental design used was a two-way analysis of variance.

In one dimension students in grades two to nine inclusive were tested using a set of achievement tests which were constructed by the author. In the other dimension, three types of instruction were considered.

The findings indicated that students in grades two and three, in the fall of the year, were unable to make valid responses using this technique. Students in grades four and five were able to make valid responses only after receiving specific instructions and a practice session. Above grade five students made valid responses regardless of the type of instructions they received. Further a set of instructions on the use of optically scored answer sheets is included.

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CHAPTER I

INTRODUCTION

In a testing situation, a systematic procedure is followed to allow a tester to compare the behaviour of two or more persons, or to measure their achievements or objectives. Irrespective of the concept that is being considered, the data gathering technique that is being utilized by the tester, should in no way bias the decision that is made.

If the systematic procedure used is a multiple choice test that requires the testee to respond on a separate answer sheet, could this technique in any way systematically bias the decision to be made? The author has noted that primary school children seem to be unable to make valid responses on an answer sheet. If this inability is a function of maturation then practice and instruction will not facilitate the use of answer sheets. On the other hand, if a student's inability to make responses on an answer sheet is in fact a function of his familiarity with the technique, then a student's performance would change markedly if he were taught how to use this technique correctly. Thus it is the purpose of this thesis firstly, to delimit the grade level and the amount of instruction necessary for students in Alberta schools to be able to make valid responses using an answer sheet and secondly, to find the types of errors are made by students at

differing grade levels in order to suggest corrective measures which could be taken to avoid such errors in the future.

For this purpose permission was gained to test students in three schools. Two schools were in the Edmonton Separate School system, St. Alphonsus and St. Edmunds, and the third was the Stettler Elementary and Junior High School. The Edmonton sample was tested in the week of October 19th and the Stettler sample was tested in the week of November 2nd.

Importance of the Study

An Operational Research Bulletin, dated October 1968 and published by the Department of Education of the Province of Alberta pointed out that optical scoring of tests and questionnaires was and is available to Alberta school systems and educational organizations. However, the bulletin failed to outline to the potential users of this service either the grade level at which valid data could be gained using this technique or what kinds of instructions would be necessary to keep the number of systematic errors made by the students at a minimum.

Further, the author has had personal experience with a number of research projects in the field of education wherein answer sheets were used without the proper safeguards. This is not to suggest that any studies using this technique and familiar to the author, jeopardized

their findings, but rather the answer sheets required visual scanning and extensive "cleaning up" before they could be scored. Perhaps with a detailed set of instructions for both the test administrator and the testees the validity of students' responses could be insured and at the same time the clerical work necessary to prepare the papers for scoring, be reduced to a minimum. Future researchers using this technique would be advised not to attempt to use it below the lower limits as defined by this study both in terms of grade level and instruction.

In summary, this study proposes to provide researchers with an adequate set of instructions for the use of answer sheets.

Limitations of the Study

Since it is the intention of the author to generalize to students in Alberta by grade levels rather than by age, no reference to age has been made. Nor is it the intent of this study to classify students by sex, although there may be differences in students' abilities if they were in fact classified in this way.

As a result of a pilot project, students in grade one were not tested as it was evident that the grade two students experienced considerable difficulty in using this technique.

Also the results will be generalized only to answer

sheets that can be scored by the IBM-1230 optical scorer.

Definition of Terms

Answer sheet. Since the Faculty of Education of the University of Alberta, Edmonton and the Department of Education of the Province of Alberta, both have IBM-1230 optical scorers, the term answer sheet, in this thesis, will refer to an IBM-5056, Department of Education, General Purpose Answer Sheet I (example given in appendix) or in general any answer sheet that the IBM-1230 optical scorer is capable of scoring.

Answer set. For each multiple choice test item there is a set of four alternative answers given. Each set being labelled a, b, c, and d, in the test booklet.

Answer spaces. For each multiple choice test item there is a corresponding set of five answer spaces provided on the answer sheet. Each set of answer spaces are labelled A, B, C, D and E and 1, 2, 3, 4 and 5.

Score. The total number of correct responses made by one individual on a particular set of items, each item being worth one, is the score for that individual.

Mark. This will be the physical mark made on the answer sheet by the student responding to a question.

Scoring. Herein, scoring will mean to process an answer sheet through the IBM-1230 optical scorer.

CHAPTER II

SOME RELEVANT LITERATURE

Although separate answer sheets to be used with paper and pencil tests were introduced into the field of testing years ago, it was not until recently that machine scored answer sheets came into being. Previously the teachers were burdened with hand scoring each child's test responses. It would seem that as long as a child's test score is not invalidated, the adoption of this technique in the school system would be highly desirable.

For a long time test publishers and educators alike have held the general opinion that primary age children are unable to use an answer sheet adequately. Curiously, research on this question is almost nonexistent.

Hieronimus (1961) using the Iowa Test of Basic Skills with third graders, found no significant difference between three methods of teaching a child to use an answer sheet. He concluded that for a normal range of ability and tests with a traditional format, third graders can use a separate answer sheet effectively.

Culhane and Stobola (1967), using a questionnaire and IBM mark-sense cards with students in grade one through grade eight, examined the question "... can children at the lower elementary school level follow the necessary marking instructions with reasonable accuracy?" In their study,

the children at each grade level were made familiar with the answer sheet and the correct marking of an answer on the mark-sense card. By considering double marks and light marks, they concluded that mark-sense cards are practical for the listing of pupil responses with children as low as grade one. They pointed out that if more explicit instructions were given as to light marks and if additional practice sessions were given at the lower grade levels, a large number of errors could possibly have been eliminated.

By giving students a practice session the day prior to their actual test, McKee (1967) trained third grade students to use an answer sheet. A sample test of five items requiring an answer sheet was used to give the students practice with the technique. Although this experiment was not carried out with all due respect for established research practices, McKee found that the practice session was successful in eliminating children's anxiety and confusion about the use of answer sheets. It was stated that this procedure of familiarizing the students with technique should be made a standard practice in the future. Furthermore, the author felt it may be desirable to use a parallel procedure to help orient students of any grade level to use an answer sheet for the first time.

Cashen and Ramseyer (1969) also viewed the question of the use of separate answer sheets by primary school

children. Their procedure was to have the students respond to the California Test of Mental Maturity Short Form, Level 1, 1963; using two answering techniques. In one administration the students were required to answer using the test booklet answer form; and in the other, the students answered on a separate answer sheet. The order of treatments were randomly assigned to each class involved. Their results showed clearly that the test booklet marking format resulted in significantly higher performance than the separate answer sheet format at both the grade one and grade two levels. At the grade three level pupils seemed to perform about as well with a separate answer sheet as they did with the booklet. The authors further suggested that perhaps with formal instruction in the use of answer sheets, the grade ones and twos would be able to make valid responses.

In summary, Hieronymous tested third grade students of a normal range of abilities with a test of a traditional format and found that they could use a separate answer sheet effectively. Culhane and Stobola, using mark-sense cards, found that after familiarizing the students with the answer sheet and the correct marking of an answer that mark-sense cards were practical for testing of pupil responses with children as low as grade one. By giving third graders a practice session, McKee was successful in eliminating childrens' anxiety and confusion about the use of an answer

sheet. Cashen and Ramseyer found that the use of separate answer sheet format resulted in a significantly lower performance at the grade one and two levels when responding to the California Test of Mental Maturity.

CHAPTER III

ADMINISTRATIVE PROCEDURE, TESTS AND INSTRUCTIONS USED

Test Construction

The task set for the students was such that the decisions made about the usefulness of an answer sheet may be generalized to any tests which made use of an answer sheet. Typically such a testing procedure would contain several components: the conception of the task to be used to measure the students' behavior, the administration of the task, the communication of a response of the testee to the tester, the scoring of the response, and the subsequent evaluation of the testee's response by the tester. The element of this procedure that will be the central topic of concern of this thesis will be the usefulness of an answer sheet as a technique of communication of a student's response to a tester.

The means of examining this construct could be illustrated by an example: In a multiple choice test using an answer sheet, a student is asked, "What is the arithmetic sum of $1 + 1$?" The student "knows" the answer to be two, and makes a mark on the answer sheet. When the answer sheet is scored and if the student receives credit for this response, this measure could be said to be a valid measure of his ability to add $1 + 1$. But if the mark on

the answer sheet is such that the student does not receive a credit for his response to that question, then this could be said to be an invalid measure of his ability to add $1 + 1$. If the tester is interested in the student's arithmetic ability, the means of communicating the answer should not systematically bias the actual construct that is being considered.

To make a decision regarding the validity of data gathered using an answer sheet, a set of tests of forty questions in length including two types of items was developed by the author. For one set of items it was assumed that all students within a grade level knew the correct answer. To provide a context for these items, the second set of test items was made more difficult. The actual responses of the students to this second set of items was not considered to be relevant to this study. The first set of items was embedded within the second set.

To check the validity of the assumption that all students within a grade level did, in fact, know the answer to these test items, a parallel treatment, A, was administered to a class of students at each grade level. Rather than have the students respond using an answer sheet, the students were requested to respond within the test booklet. These test responses were subsequently transferred manually by the author to an answer sheet, and were scored and analyzed to determine the question that had a low difficulty. The

criterion for classifying an item as having a low difficulty was that not more than one student in the A treatment at a grade level failed to respond correctly. At each grade level, seven items met this criterion. The tests used are included in Appendix A. The specific items that were used as the dependent variable are marked.

The responses of the students in the other treatments (B, C and D) to this set of items provided the dependent variable for this thesis. The independent variables used were the grade levels two to nine inclusive, and three types of instructions.

Test Instructions

The two dimensions to be considered in this study are the grade level of the students and the amount of instruction they received.

In treatment B in the Stettler sample, students were given a test booklet and an answer sheet. All the instruction these students received was, "Indicate the answer by placing a mark between the guidelines as shown in the example. Use an HB pencil." This was the minimum amount of instruction given in any treatment (see Appendix B).

In treatment B in the Edmonton sample, the second set of instructions (Appendix C) was adapted from a set used by Bicknell and Nyberg (1970) in a study for the Department of Education, of the Province of Alberta (see

Appendix H). This set of instructions included several general remarks and suggestions as to the proper use of an answer sheet.

The third set of instructions (Appendix D) was more specific. This was a rewording of the instruction set provided by the Division of Educational Research Services, the University of Alberta, Edmonton, Canada, for the use of answer sheets (see Appendix G). In both the Edmonton and Stettler samples this set of instructions was used for treatments C and D.

In treatment D, a practice test was given in which each of the concepts that were referred to in instructions were illustrated. Thus, students in this treatment received both the detailed set of instructions and a practice set (see Appendix E).

In the Instruction dimension there is a gradient in the amount of instruction and practice received by the students from a minimum of instruction and no practice in treatment B to a maximum of detailed instruction and a practice session in treatment D. By using such a range of instruction, differences in abilities could be more easily identified.

Administrative Procedure for the Tests

After randomly assigning each class to a treatment, pamphlets were made up to contain the Instructions to Administrators, Instructions for the Test, Administrators

Copy of the Test, test booklets and answer sheets. The instructions and test items were read to the students in grades two to four for all treatments; above grade four, only the instructions were read to the students (see Appendix F).

For treatments A, B and C, the pamphlets were distributed to the teachers concerned to administer. Within each school and at each grade level, treatments A, B and C were administered at one time by the classroom teachers.

Subsequently, the author administered treatment D, which gave the students practice in using the technique by responding to a set of sample questions. For each grade level the practice test was parallel in form and content to the main test. Also, the class worked through the practice test together selecting the correct alternative. The author and the home room teacher circulated within the class to check to see that each student was in fact able to make an answer in the correct manner.

This practice test, written immediately prior to the main test, was used to familiarize the students with these concepts:

(a) For each test question there was given an answer set labelled a, b, c and d on the test booklet. Corresponding to each answer set there was a set of answer spaces labelled A, B, C and D. For each question the

students were instructed to decide which answer was correct and then to make a mark in the corresponding answer space.

(b) Each set of answer spaces was also numbered 1, 2, 3, 4 and 5. The students were instructed to disregard these labels in marking their response to a question.

(c) The required size, shape and density of a mark was pointed out.

(d) The answer spaces proceed columnwise, thirty-five to a column.

In summary, the task was a set of achievement tests of forty questions in length and containing two types of items. One set of test items was set so that each student at a grade level was assumed to know the correct answer. The second set of items provided an overall task for the students of an achievement test. A set of instructions was also developed. This set of instructions varied from nonspecific to a very specific set with a practice session. Further, the administrative procedure followed by the author was outlined.

CHAPTER IV

PILOT STUDY

In the week of October 5th, 1969, seven heterogeneous classes of students from the Edmonton school system were selected for a trial test administration. Table 1 shows the specific number of students and schools involved. As there were only four classes available for testing in the main study at grades three and six, no classes were available for the pilot study from these grade levels.

TABLE 1
SAMPLE SIZES IN PILOT STUDY

Grade Tested	Name of the School	Number of Students
2	St. Alphonsus	23
2	St. Edmunds	25
4	St. Alphonsus	25
5	St. Edmunds	24
7	Donnan Junior High	31
8	Donnan Junior High	30
9	Donnan Junior High	28
Total		186

By personally administering the set of tests, the author was able to practice the administrative procedure for treatment D, and at the same time note any difficulties the

students had in taking the test.

Subsequently, the answer sheets were scored and punched on cards for analysis. The data were used to check for any changes in the abilities of students to respond using answer sheets over the grade levels included in the pilot study. For the particular set of instructions used, it was noted that grade two students had difficulty in making valid responses, whereas grade four students and older seemed to make more valid responses.

For each grade level, the Division of Educational Research Services (1969) item analysis program was used to help point out flaws in the test set. Primarily, typographical and clerical errors were detected.

CHAPTER V

MAIN STUDY

Statistical Procedures Used

For the explicit purpose of this study there was a set of test items the answers to which were assumed to be known by each testee for a given grade level. By analyzing the responses made to this set of items, it was possible to examine a general underlying assumption in testing that the person being tested is capable of communicating his perceived answer to the scorer in such a form that the scorer is able to evaluate, by implication, what the testee perceived as being the correct answer. At each grade level there were seven items in this "known" group.

Model to be Used (Winer, 1962)

The model used was a $p \times q$ completely fixed factorial design where factor p is grade level with grades two to nine inclusive being considered, and factor q is type of instructions being given. Three sets of instructions were used.

Underlying Theoretical Model

$$X_{ijk} = \mu + \alpha_i + \beta_j + \alpha\beta_{ij} + e_{ijk}$$

where:

X_{ijk} is the observed score for person k in grade i under treatment j .

- μ is the population mean.
- α_i is the differential effect due to grade i .
- β_j is the differential effect due to treatment j .
- $\alpha\beta_{ij}$ is the differential effect due to an interaction between grade i and treatment j .
- e_{ijk} is the individual difference component for person k .

Verbal Hypotheses

- H_0 : The data gained by means of an answer sheet from students in each of grades two to nine are valid.
- H_1 : The data gained by means of an answer sheet from students in each of grades two to nine are invalid.
- H_0 : The validity of data gained by means of an answer sheet for each grades two to nine is not affected by the type of instruction given.
- H_1 : The validity of data gained by means of an answer sheet for each of grades two to nine is affected by the type of instructions given.

Model Type

Grade levels of students is a fixed factor since this study will only generalize to the particular grade levels studied. Also levels of instruction is a fixed factor since this study will only generalize to the

particular types of instructions used.

Underlying Assumptions of Analysis of Variance

- (a) Variance due to individual differences within each of the treatment populations is homogeneous.
- (b) Treatment effects are additive.
- (c) The observed scores are based on an interval scale of measure.
- (d) The experimental errors are independently and normally distributed within each of the pq populations with a mean of zero and common variance of σ_e^2 .

Treatment of the Data

The observed data were tabulated in a table with eight rows (factor p) and three columns (factor q). By considering the computational symbols, a summary of the analysis of variance was computed using ANOV 25 of the Division of Educational Research Services (1969). The expected values required for the analysis of variance were as given in Table 2.

TABLE 2
COMPUTATIONAL SYMBOLS USED IN COMPUTING
AN ANALYSIS OF VARIANCE

Source of Variation	Degrees of Freedom	Mean Squares	Expected Mean Squares	F Ratio
Main effect of A	(p-1)	ms_a	$\sigma_\epsilon^2 + 9 \sigma_\alpha^2$	$ms_a \div ms_w \text{ cell}$
Main effect of B	(q-1)	ms_b	$\sigma_\epsilon^2 + 6 \sigma_\alpha^2$	$ms_b \div ms_w \text{ cell}$
Interaction of AB	(p-1)(q-1)	ms_{ab}	$\sigma_\epsilon^2 + 3 \sigma_{\alpha\beta}^2$	$ms_{ab} \div ms_w \text{ cell}$
Within cell	qp(n-1)	$ms_w \text{ cell}$	σ_ϵ^2	
Total	npq-1			

ANOV 25 carried out a two-way analysis of variance with unequal observations per cell assuming fixed effect model. Firstly, the additive model (2) is tested against a more general model applying the least square techniques to test the interaction effect.

$$X_{ijk} = \mu + \alpha_i + \beta_j + e_{ijk} \quad (1)$$

$$X_{ijk} = \mu + \alpha_i + \beta_j + \alpha\beta_{ij} + e_{ijk} \quad (2)$$

If the interaction effect is found to be not significant, model (1) is used assuming no interaction. If the interaction is found to be significant, model (2) is used.

Statistical Hypothesis Regarding the Main Effects

$$(a) \quad H_0: \quad \alpha_i = \alpha_{i'}$$

$$H_1: \quad \alpha_i \neq \alpha_{i'}$$

For all $i \neq i'$

$$(b) \quad H_0: \quad \beta_j = \beta_{j'}$$

$$H_1: \quad \beta_j \neq \beta_{j'}$$

For all $j \neq j'$

$$(c) \quad H_0: \quad \alpha\beta_{ij} = \alpha\beta_{i'j'}$$

$$H_1: \quad \alpha\beta_{ij} \neq \alpha\beta_{i'j'}$$

For all $(ij) \neq (i'j')$

Decision Rule

If the F observed is greater than the F critical, reject H_0 and accept H_1 , where the critical value of F is given by:

$$A: \quad F_{1-\alpha} [(p-1), (N-pq)]$$

$$B: \quad F_{1-\alpha} [(q-1), (N-pq)]$$

$$C: \quad F_{1-\alpha} [(p-1)(q-1), (N-pq)]$$

Here the number of persons in each cell ranged from twelve to thirty-one, the number of grade levels (p) considered was eight, and three types of instructions (q) were used. The F's were considered for α 's of 0.01.

The Edmonton Sample

In the week of October 19th, 1969, sample classes were drawn from two Edmonton schools, St. Alphonsus and St. Edmunds. These heterogeneous classes were assigned randomly to treatments. Table 3 shows the number of students involved. The tests were administered following the procedure as outlined in the section of this thesis entitled Administrative Procedure for the Test. Subsequently, the dependent variable scores were calculated. The data handling procedures for both the Edmonton and Stettler samples are described below.

TABLE 3

NUMBER OF STUDENTS IN EDMONTON SAMPLE

Treatment	A	B	C	D
Grade				
2	24	26	27	29
3	24	24	22	25
4	30	23	28	24
5	26	24	27	25
6	26	25	31	29
7	24	26	28	31
8	24	25	25	22
9	30	29	28	29

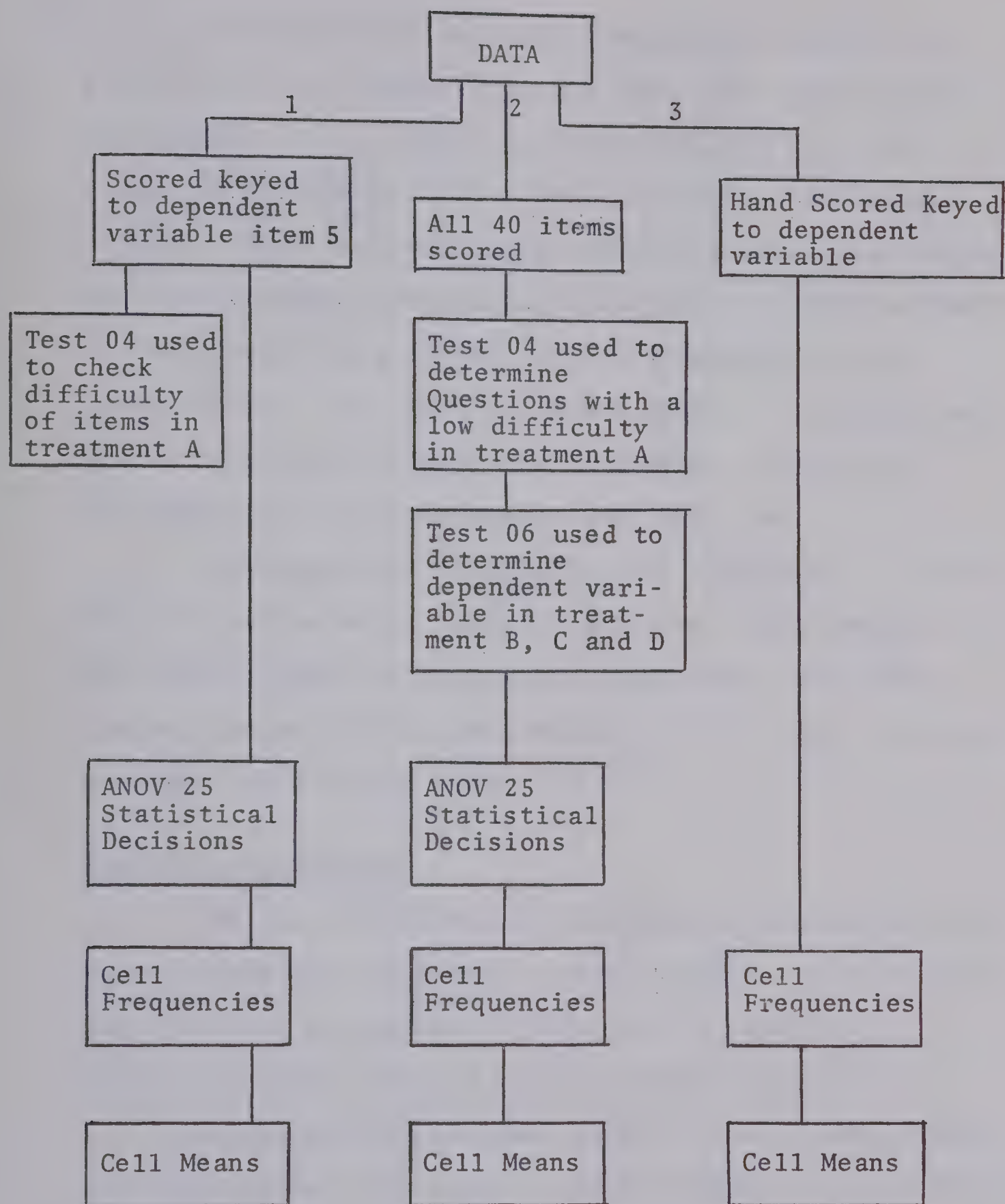
To be able to comment on the validity and reliability of the data handling procedure two parallel and independent

procedures were followed (see Figure 1). The three branches of this figure will be outlined. In each case the procedure begins with the raw data.

In branch one, the answer sheets were scored, keyed for the seven questions that comprised the dependent variable. TEST 04 of the Division of Educational Research Services (1969) was used to check that the questions in treatment A that constituted the dependent variable did meet the criteria of low difficulty. Then ANOV 25 of the Division of Educational Research Services (1969) was used to make the statistical decisions and to provide an estimate of cell means and cell frequencies.

In branch two, all the forty items were scored and TEST 04 of the Division of Educational Research Services (1969) was used to determine the questions in treatment A that did meet the criteria of having a low difficulty. Then TEST 06 of the Division of Educational Research Services (1969) was used to rescore treatments B, C and D keyed only for the seven questions that constituted the dependent variable. ANOV 25 of the Division of Educational Research Services (1969) was used to make the statistical decisions and estimate the cell means and cell frequencies.

In the third branch, the data were hand scored, keyed to the seven questions that constituted the dependent variable. This provided an estimate of the cell means and cell frequencies.



Note: TEST 04, TEST 06, and ANOV 25 were programs of the Division of Educational Research Services (1969).

FIGURE 1

FLOW CHART OF THE PROCEDURAL CHECK

The cell means and cell frequencies derived in each branch were compared to see that they agreed within acceptable limits. Exact agreement was not expected since the machine's scoring does not have a reliability of one. Since the cell means and cell frequencies did in fact agree within acceptable limits this provided a check on the transferring of the data in treatment A to the answer sheets. The ANOV 25 of the Division of Educational Research Services (1969) used in branch one and two provided a check on the statistical decision.

In summary, by considering the reliability of three separate estimates of the cell means and cell frequencies and two estimates of statistical decisions, the author checked the reliability and validity of the data handling procedure used in the study.

Analysis of Variance

The test of additivity showed the interaction term to be significant so model (2) was tenable. This indicated that students at different grade levels benefited differently from the type of instruction they received.

In considering the main effects a weighting system was used. Since this study intends to generalize to Alberta schools by grade, the samples by grade were weighted proportionally to the numbers of school children enrolled in that grade as reported by the Department of Education of the province of Alberta Annual Report 1968 (see Table 4).

These were the most recent statistics available.

TABLE 4
DISTRIBUTION OF PUPILS BY GRADE AS OF
SEPTEMBER 30, 1967 IN ALBERTA

Grade	Number of Pupils	Proportion of Total
2	38,277	0.13921
3	36,715	0.13353
4	36,084	0.13124
5	34,408	0.12514
6	33,403	0.12149
7	34,239	0.12453
8	32,336	0.11761
9	29,491	0.10726

The analysis of variance of main effects indicated that there was a significant grade effect, a significant instruction effect, and a significant interaction (see Table 5). The grade effect means that students' ability to use an answer sheet changed from grades two to nine. The instruction effect means that the students' performance changed considering three types of instruction.

TABLE 5

ANALYSIS OF VARIANCE FOR THE EDMONTON SAMPLE

(This solution is based on weighted main effects and tested without the additivity assumption)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F Ratio	Probabilities of F
Main effects of Grades	361.97	7	51.71	40.71	0.000002
Main effects of Instruction	20.16	2	10.08	7.93	0.00040
Interaction effect of Instructions and Grades	49.03	14	3.50	2.75	0.00057
Within Cell	774.80	610	1.27		

To aid in interpreting this change in performance, Scheffé multiple comparisons of grade level means was performed. The results were tabulated in Table 7, using the weighted means as tabulated in Table 6. It can be seen from this table that the performance of the grade two students differed significantly from all other grades. Also grade three students differed significantly in performance from grades six, seven, eight and nine; and grade four students differed from grade nine.

TABLE 6

WEIGHTS AND MEANS USED IN THE SCHEFFÉ TEST FOR THE EDMONTON SAMPLE

<u>Weights used for levels of factor A (grades):</u>								
Grade	2	3	4	5	6	7		
Weight								
Used	0.13921	0.13353	0.13124	0.12514	0.12149	0.12453		
Grade	8	9						
Weight								
Used	0.11761	0.10726						
<u>Means by Grades:</u>								
Grade	2	3	4	5	6	7	8	9
Weighted								
Main Effect	4.50	6.06	6.23	6.35	6.80	6.77	6.87	6.87
<u>Weight used for levels of B (treatments):</u>								
Treatment	B	C	D					
Weight Used	0.33333	0.33333	0.33334					
<u>Means by Treatments:</u>								
Treatment	B	C	D					
Mean	6.02	6.30	6.46					

TABLE 7

SCHEFFÉ MULTIPLE COMPARISONS OF MEANS BY GRADES FOR THE EDMONTON SAMPLE

Grade \ Grade	2	3	4	5	6	7	8	9
2		*	*	*	*	*	*	*
3					0.02	0.035	0.01	0.006
4							0.10	0.06
5								
6								
7								
8								
9								

* $p \leq 0.001$

In the other dimension when type of instructions were considered, it was noted that the performance under instruction set 1 was different from the performance under instruction set 2 and set 3 (Table 8).

TABLE 8

SCHEFFÉ MULTIPLE COMPARISONS OF MEANS BY TREATMENTS
FOR EDMONTON SAMPLE

	B	C	D
B		0.04	0.0005
C			0.361
D			

Since the interaction term in the analysis of variance proved to be statistically significant, it was necessary to analyze the simple main effects. In the one dimension, it was of interest to see if for each grade level the mean criterion scores differed over the type of instruction given. Profiles of simple main effects were graphed by plotting the mean criterion score versus treatment classification by grade level (see Figures 2 and 3). In the other dimension it was of interest to see if for each treatment the mean criterion scores differed across grade levels. Profiles of simple main effects were graphed (Figure 4) by plotting the mean criterion score (Table 9) versus grade level by treatment.

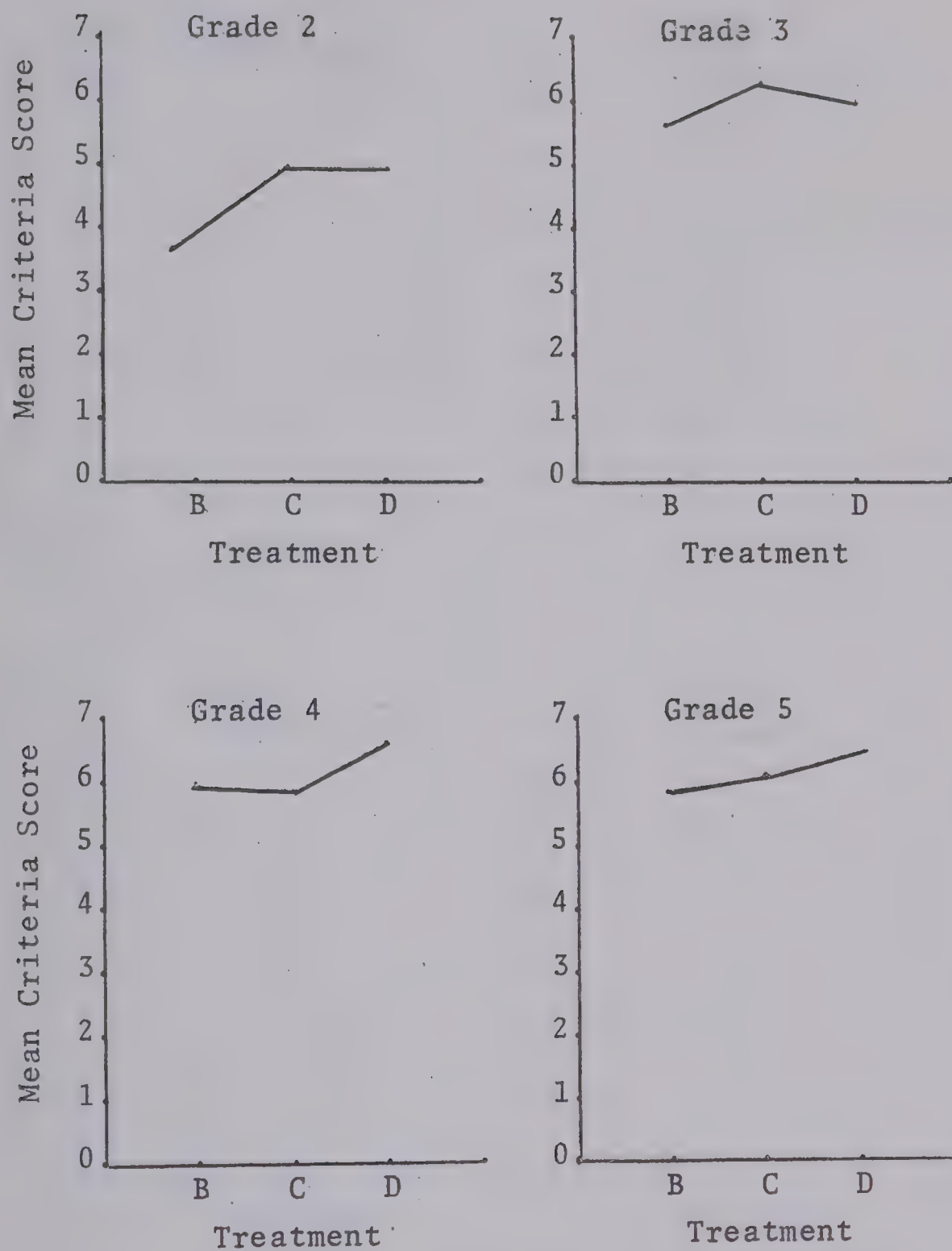


FIGURE 2

SIMPLE MAIN EFFECTS FOR THE EDMONTON SAMPLE BY
GRADE FOR GRADES 2 TO 5

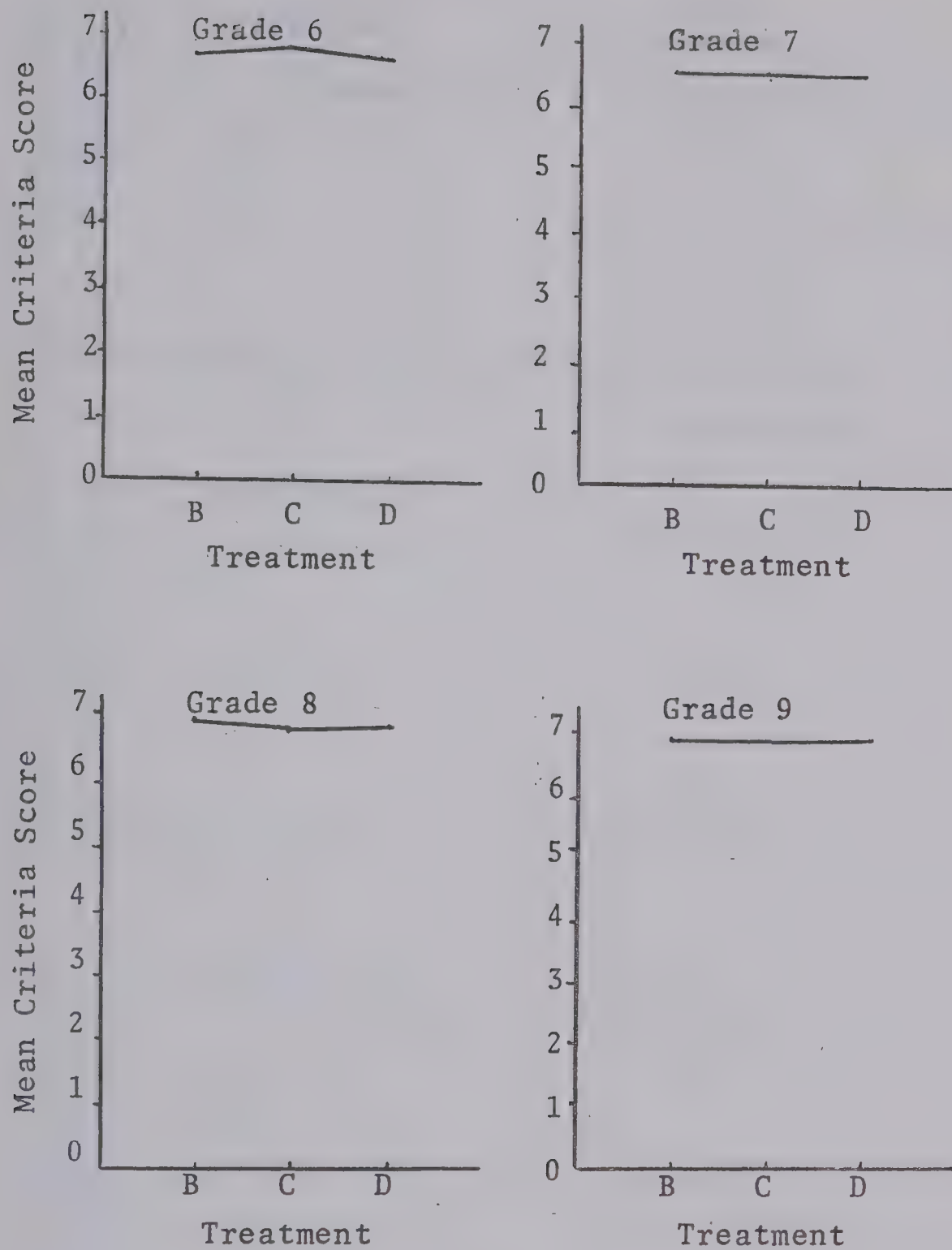


FIGURE 3

SIMPLE MAIN EFFECTS FOR THE EDMONTON SAMPLE BY
GRADE FOR GRADES 6 TO 9

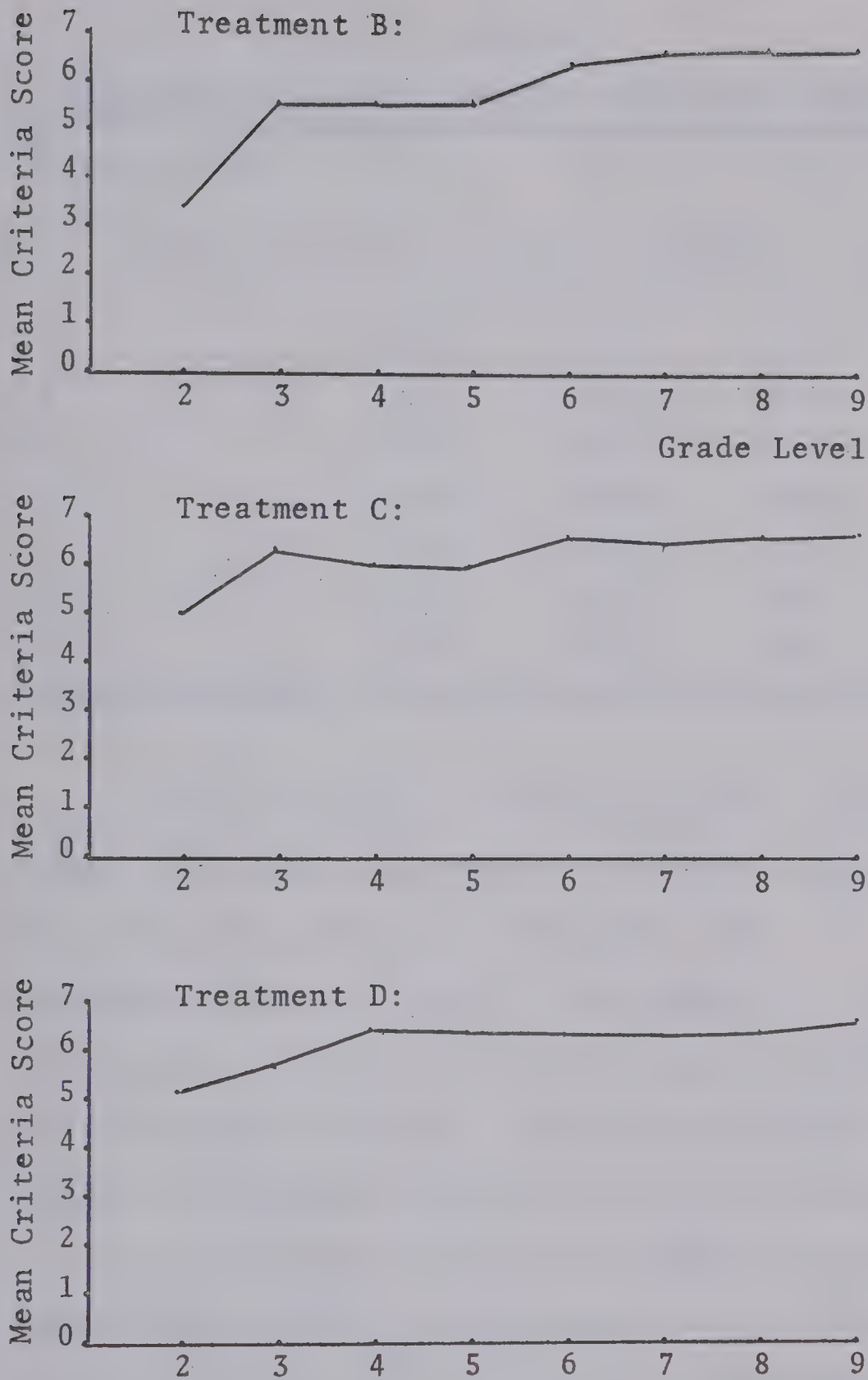


FIGURE 4

SIMPLE MAIN EFFECTS FOR THE EDMONTON SAMPLE BY TREATMENTS

TABLE 9

CELL MEANS FOR THE EDMONTON SAMPLE BY TREATMENT

Treatment Grade	A	B	C	D
2	7.00	3.42	4.96	5.10
3	7.00	5.72	6.32	6.16
4	7.00	6.00	5.93	6.75
5	7.00	6.12	6.26	6.65
6	7.00	6.76	6.84	6.79
7	7.00	6.88	6.71	6.71
8	7.00	6.92	6.84	6.86
9	7.00	6.86	6.86	6.90

From the graphs of the simple main effects by grades, it can be seen that at the grade levels two to five there was a trend in the means from low to high from treatments B to D. That is, the numbers of errors made when using an answer sheet were least in treatment D and greatest in treatment B. Further it was noted that the largest differences occurred at the lower grade levels.

But when considering the graphs, Figure 3 of the simple main effects for the grades six to nine, the numbers of errors made seemed to be independent of the type of instructions the students received.

When considering the simple main effects of grades, within each treatment it was noted that there was a trend in the numbers of errors made by students being greatest

at grade two and least in grade nine. The single largest difference being noted between grades two and three (see Figure 4).

In summary, the analysis of variance indicated that grade two and three students were unable to make valid responses at an acceptable level regardless of the type of instruction given. Grade four and five students were able to make valid responses when given a detailed set of instructions and a practice session. Students in grades above five, made valid responses regardless of the type of instructions they received.

A tabulation of the specific types of errors made by the students, is shown in Table 10. Other possible sources of confusion when students were making responses were:

(a) The grade twos were confused in the change from lower case letters in the designation of the answer set to the upper case designation of the answer spaces.

(b) In the arithmetic subtest, although the answer sets were labelled a, b, c and d, students often responded in answer spaces numbered the same as the correct answer, rather than by the letter designation of the answer space.

The most common type of errors were multiple marks and poor erasures. So in administering a test using an answer sheet, students should be given specific instructions in this regard. Further, for this scoring machine light

TABLE 10
ERRORS MADE BY STUDENTS WHEN RESPONDING

Grade	Treatment	Multiple Marks	Poor Erasure	Others	Sum
2	B	16	6	3	25
	C	11	13	9	33
	D	12	13	0	25
3	B	6	8	1	15
	C	2	0	0	2
	D	5	2	1	8
4	B	4	0	0	4
	C	5	4	0	9
	D	0	0	0	0
5	B	1	0	0	1
	C	1	0	0	1
	D	1	2	0	3
6	B	3	0	0	3
	C	1	1	0	2
	D	1	1	0	2
7	B	4	1	0	5
	C	2	1	0	3
	D	1	0	0	1
8	B	0	0	0	0
	C	3	0	0	3
	D	0	0	2	2
9	B	1	0	0	1
	C	0	2	0	2
	D	2	0	0	2

Others included: (in descending order of frequency).

1. Poorly made marks. That is, marks that were too light, long, short, or thick.
2. The students were noted to have either omitted a question or an answer space, thereby completing part of the test incorrectly.
3. The students were noted to proceed into Part II of the answer sheet to respond to question 36 rather than going to the top of the second column of answer spaces.

marks did not seem to be a problem.

The Stettler Sample

In the week of November 2nd, 1969, classes in the Stettler elementary and junior high school were assigned to treatments randomly. These classes were homogeneously grouped by ability. Therefore at each grade level type of instruction was confounded with ability grouping. Table 11 shows the numbers of students involved at each grade level. The same administrative procedure was followed as in the Edmonton sample, and the dependent variable scores were calculated using the same questions for the dependent variable.

TABLE 11
NUMBERS OF STUDENTS IN THE STETTLER SAMPLE

Treatment Grade	A	B	C	D
2	27	14*	27	25
3	25	24	31	14*
4	30	24	18*	29
5	21	23	15*	21
6	33	29	20*	25
7	20	21	27	21
8	30	12*	31	29
9	25	26	24	28

*These classes are in a four year remedial program.

Analysis of Variance

The test of additivity showed the interaction term to be significant. So model (2) was tenable indicating that students at different grade levels benefited differently from the type of instruction they received.

Again, in considering the main effects, a weighting system was used to weight the samples proportionally to the numbers of school children enrolled in that grade in 1968 in Alberta schools. This analysis (Table 12) indicated that there was a significant grade effect, and interaction effect, but the instruction effect proved to be non-significant having a probability of 0.045. As in the Edmonton sample students' abilities to use an answer sheet changed from grade two to eight.

TABLE 12

ANALYSIS OF VARIANCE FOR THE STETTLER SAMPLE

(This solution is based on weighted main effects and tested without the additivity assumption)

Source	Sum of Squares	Degrees of Freedom	Mean Squares	F Ratio	Probabilities
Grades (A)	86.51	7	12.36	14.43	0.000003
Instruc-tions (B)	5.35	2	2.67	3.12	0.045
S(AB)	34.77	14	2.48	2.90	0.0003
S(E)	457.48	534	0.86		

A Scheffé multiple comparison of means was done considering the students grade levels. The results were tabulated in Table 14 using the weighted means as tabulated in Table 13. It can be seen from the table that the performance of the grade two students differed significantly from all other grade levels.

TABLE 13

WEIGHTS AND MEANS USED IN THE SCHEFFÉ TEST FOR THE STETTLER SAMPLE

Weights used for levels of factor A (Grades):

Grade	2	3	4	5	6
Weight Used	0.13921	0.13353	0.13124	0.12514	0.12199
Grade	7	8	9		
Weight Used	0.12453	0.11761	0.10726		

Means by Grades:

Grade	2	3	4	5	6	7	8	9
Mean	5.56	6.43	6.30	6.75	6.76	6.80	6.79	6.87

Weights used for levels of factor B (Treatments):

Treatment	B	C	D
Weight Used	0.33333	0.33333	0.33334

Means by Treatments:

Treatment	B	C	D
Mean	6.49	6.40	6.64

TABLE 14

SCHEFFE MULTIPLE COMPARISONS OF MEANS BY GRADES FOR
THE STETTLER SAMPLE

Grade	2	3	4	5	6	7	8	9
Grade								
2		*	0.004	*	*	*	*	*
3								
4								
5								
6								
7								
8								
9								

* $p > 0.001$

In the treatment dimension, it was noted that the remedial classes tended to have lower cell means than the other students at that grade level irrespective of the instructional treatment they received. Thus there was a confounding effect of ability by treatment resulting in no significant difference in the instruction dimension at the $\alpha = 0.01$ level. But at the $\alpha = 0.05$ level of significance, the instruction effect was significant as a observed = 0.045.

Since the interaction term in the analysis of variance proved to be statistically significant, it was necessary to analyze the simple main effects. In the one dimension, it was of interest to see if for each grade level the criterion scores differed over the types of instructions given. As for the Edmonton sample, profiles of simple main effects were plotted (see Figures 5 and 6). But because of

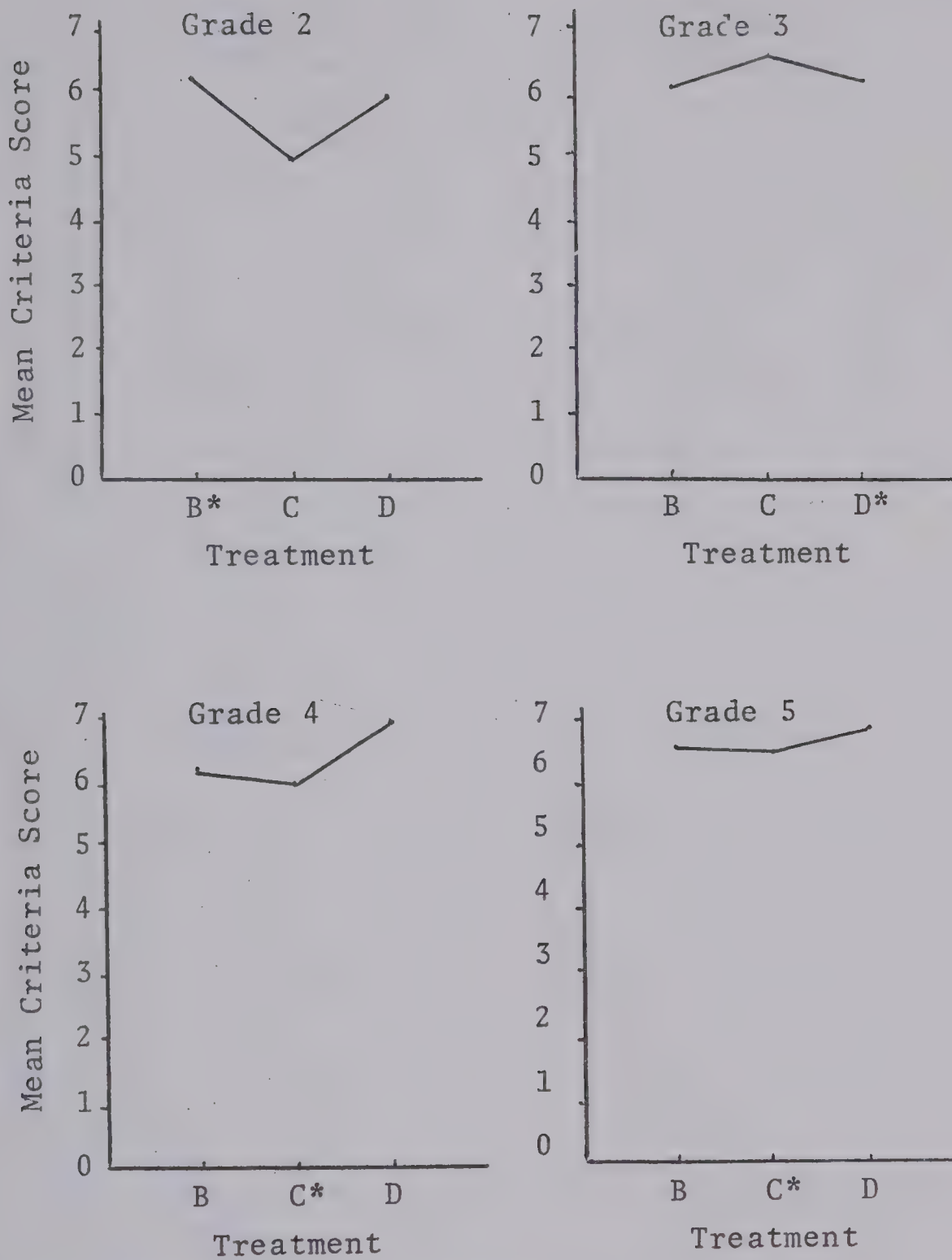
the confounding of the treatment with the ability of the students, interpretation of the effect of treatment by grade was difficult. However in examining the simple main effects by grades within each treatment a trend was noted from lowest to highest from grade two to nine (see Figure 7). Also the single largest difference was noted between grades two and three. Table 15 contains a summary of cell means used in these graphs.

TABLE 15
CELL MEANS FOR THE STETTLER SAMPLE BY TREATMENT

Treatment	A	B	C	D
Grade				
2	7.00	6.21*	4.85	5.60
3	7.00	6.29	6.64	6.36*
4	7.00	6.04	6.00*	6.86
5	7.00	6.65	6.60*	7.00
6	7.00	6.86	6.50*	6.92
7	7.00	6.57	6.93	6.90
8	7.00	6.58*	7.00	6.79
9	7.00	6.81	6.96	6.86

* Classes in a four year remedial program.

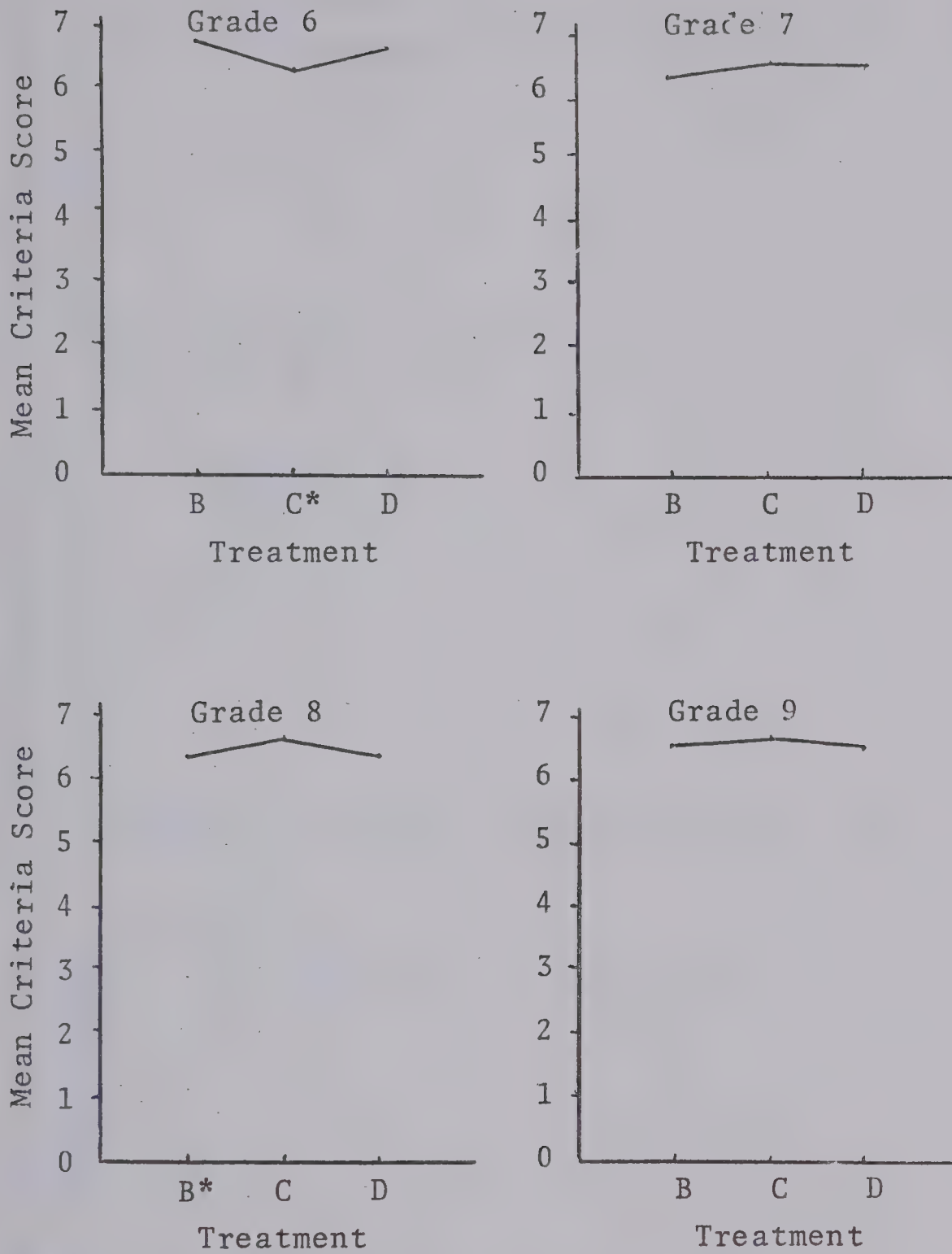
In summary, for the Stettler sample the analysis of variance indicated that grade two students were unable to make valid responses at an acceptable level regardless of the type of instruction given. Grade three, four and five students were able to make valid responses when given a detailed set of instructions and a practice session.



* - Class in four year remedial program.

FIGURE 5

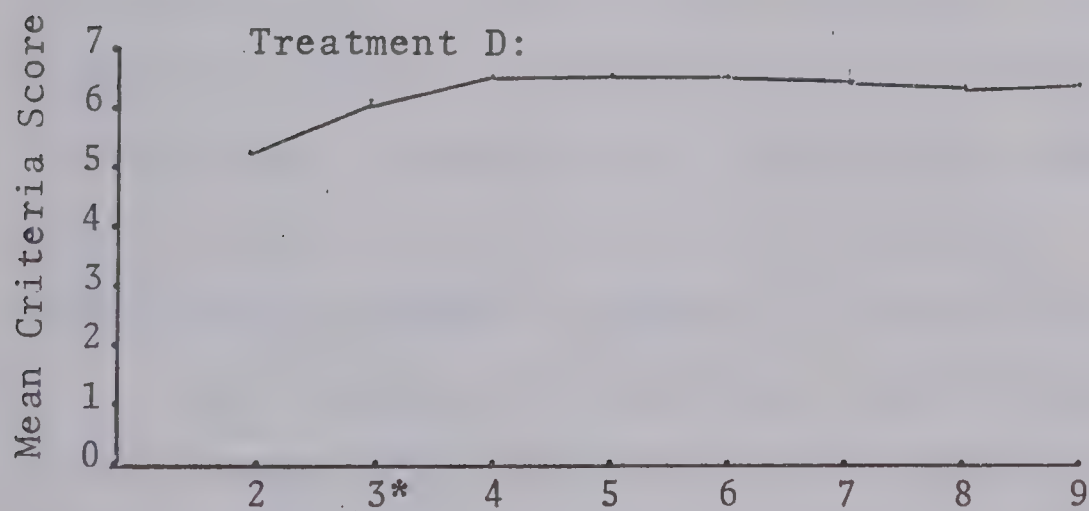
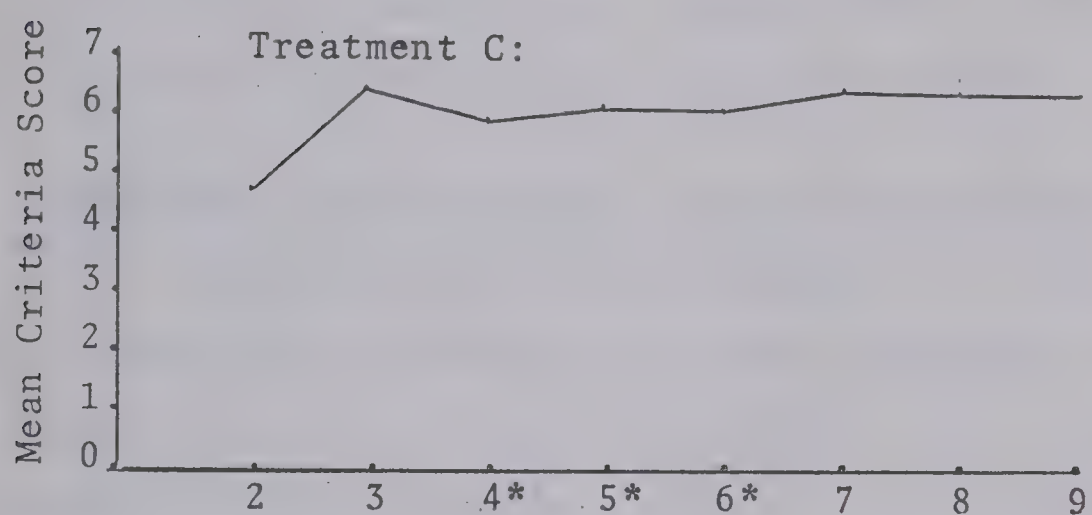
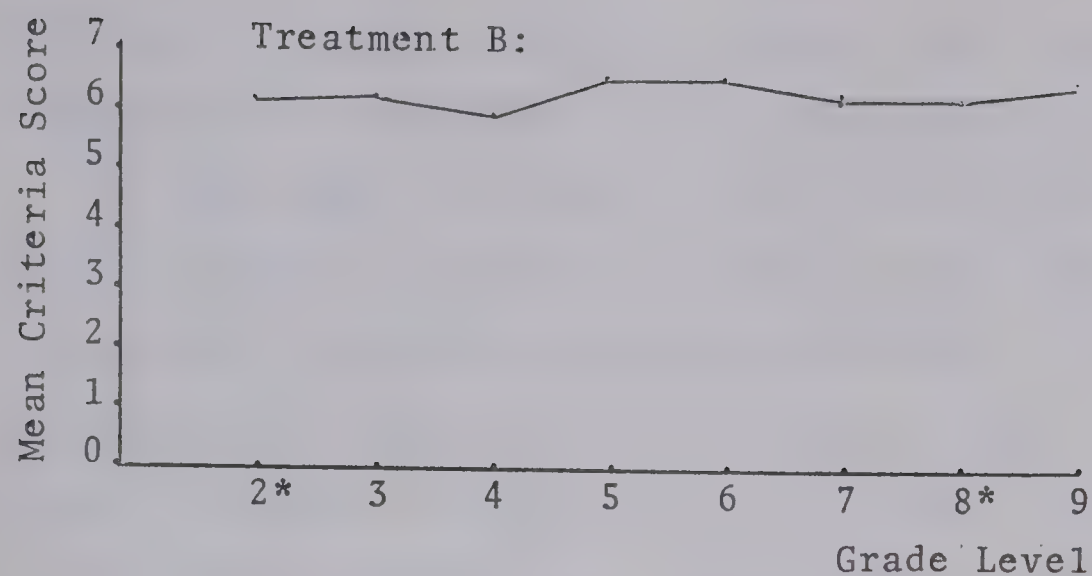
SIMPLE MAIN EFFECTS FOR STETTLER SAMPLE BY
GRADE FOR GRADES 2 TO 5



* - Class in four year remedial program.

FIGURE 6

SIMPLE MAIN EFFECTS FOR THE STETTLE SAMPLE BY
GRADE FOR GRADES 6 TO 9



* - Class in a four year remedial program.

FIGURE 7

SIMPLE MAIN EFFECTS FOR THE STETTLER SAMPLE BY TREATMENTS

Students in grades above five, made valid responses regardless of the type of instructions they received.

The specific types of errors made by the students were tabulated in Table 16. Again it was noted the grade two's were confused in the change of case of the letter designation of the answer set and the answer spaces. Also the number designation of the answer spaces caused some students difficulty. Again the most common type of errors were multiple marks and poor erasures.

Comparison of the Edmonton and Stettler Samples

When comparing the B treatments for the two samples it should be remembered that after comparing the actual instruction sets used in treatments B and C (Appendix C and D), for the Edmonton sample, it was decided to alter the instruction set used in the B treatment for the Stettler sample to provide a greater degree of variability among instructions. Consequently, the Stettler students were given a less specific set of instructions for the B treatment than the Edmonton students. (Appendix B).

For purposes of comparison, considering the graphs of the simple main effects for both samples by grade, some important consistencies were evident. When considering the graphs (Figures 2 and 5) for grades two to five for both samples, the grade twos' and threes' in both cases were unable to make valid responses regardless of the type of instruction they received. The grade four and

TABLE 16
ERRORS MADE BY STUDENTS WHEN RESPONDING

Grade	Treatment	Multiple Marks	Poor Erasure	Others	Sum
2	B	2	0	0	2
	C	7	4	1	12
	D	6	4	4	14
3	B	4	6	0	10
	C	5	2	0	7
	D	1	0	0	1
4	B	6	2	0	8
	C	0	0	4	4
	D	0	0	3	3
5	B	1	1	1	3
	C	0	1	1	2
	D	1	0	1	2
6	B	0	1	4	5
	C	0	0	2	2
	D	0	0	0	0
7	B	3	4	1	8
	C	2	1	2	5
	D	2	0	0	2
8	B	0	1	0	1
	C	0	0	0	0
	D	1	0	0	1
9	B	0	0	0	0
	C	2	0	1	3
	D	0	0	0	0

five students benefited differentially from the different types of instructions they received. Namely, the students who received the D treatment made valid responses whereas the students in treatments B and C did not. In grades six through nine in both samples (Figures 3 and 6), the responses made by the students were valid.

One atypical class mean was observed, grade two, treatment B of the Stettler sample (Figure 5). For although this was a remedial class and received the least amount of instruction, their mean score (6.21) was higher than any of the other grade two scores in either sample. Considering their ability grouping, it is difficult to understand why these students would display such a high score when no other remedial class did. Perhaps this high score could be due to a nonuniform application of the test instructions by the classroom teacher.

CHAPTER VI

SUMMARY AND RECOMMENDATIONS

In considering the results it should be remembered that the tests were administered to the students in the fall of the year. The grade designation refers to students' grade level as of the date of testing. Secondly, the conclusions rest on the assumption that the items to which group A students responded in a near errorless fashion would also have been responded to in an errorless fashion by the students in groups B, C and D at that grade level if they had responded in the test booklet rather than on an answer sheet.

In the Edmonton sample, the analysis of variance indicated that grade two and three students were unable to make valid responses at an acceptable level regardless of the instructions given. Grade four and five students were able to make valid responses when given a detailed set of instructions and a practice session. Students in grades above five, made valid responses regardless of the type of instruction they received. In the Stettler sample, the analysis of variance indicated that grade two students are unable to make valid responses at an acceptable level regardless of the type of instruction given. Grade three, four and five students were able to make valid responses only when given a detailed set of instructions and a

practice session. Above grade five students made valid responses regardless of the type of instruction they received.

In terms of the verbal hypotheses being tested the data gained by means of an answer sheet from students in grade two and three are invalid regardless of the instructions given to the students. In grades four and five a detailed set of instructions and a practice session are required to insure the validity of the data. Above grade five, the data gained by means of an answer sheet were valid regardless of the type of instruction. Further, by examining the difficulty level of all test items in treatments B, C and D, it was concluded that the converse conclusion was not tenable. That is, only two items at the grade three level and one item at the grade four level would support the hypothesis that students answering on an answer sheet performed better than the students who responded in the test booklet.

When preparing an examination that uses an answer sheet an examiner should bear in mind that younger students can be confused by changes in labelling from an answer set to an answer space. Specifically, some students at the lower grade levels were confused when the answer set was labelled in lower case letters and the answer spaces were labelled with capital letters. Further, on the arithmetic subtest, some students responded in answer spaces numbered

the same as the correct answer rather than by the letter designation of the answer space.

On the basis of the study a number of recommendations to prospective users are possible.

Recommendations for the Instructor

(a) Although blank answer sheets can be overprinted with a non-reflecting ink, answer sheets duplicated or printed by other means will not meet the specifications of tolerance for the IBM-1230 optical scoring machine and thus cannot be scored by an optical scorer.

(b) Ensure that neither the student nor the examiner place any marks of any kind among the timing lines (the black lines in the right-hand margin of the answer sheet). Watch particularly to ensure that the personal information such as the name of the school and the name of the test are not run into the timing marks.

(c) Decide in advance what additional information you will require for each student and, whenever possible have the student code this data on the answer sheet at the time of testing.

(d) Make certain that each student has a sharp HB (medium soft) pencil for marking answers.

Do Not Use: (1) an IBM electrographic pencil,
(2) an H, 2H, 3H, etc. pencil,
(3) a pen,
(4) a felt tipped marking pen.

Above grade seven, the examiner should provide pencils to students for examination purposes.

(e) When storing answer sheets keep them flat. Do not fold, staple, or bend any of the corners.

(f) If each student is to receive a set of answer sheets, it is best to staple these together on the lower left hand corner of the answer sheet. This is because the top of the answer sheet is the leading edge that goes into the optical scorer and should be as free from folds, bends or tears as possible.

Recommendations for the Students

(a) Do not mark more than one answer to each question. The optical scorer will score as wrong any question with more than one answer indicated. Stray pencil marks, smudges or dots on the guidelines might also be interpreted by the machine as "double-answers" and cause an item to be marked wrong.

(b) If you change your mind about an answer, erase the unwanted answer completely. Poor or smudged erasures may be read by the machine.

(c) When indicating answers, blacken the entire space between the guidelines corresponding to each choice. Do not make a mark larger than the guidelines. While the scoring machine has considerable tolerance with respect to marks that are too long, too short or too light; carelessly

made marks increase the chances of a question being marked wrong by the machine. The most satisfactory marks are made by using a sharp pencil and stroking over the guidelines two or three times. A dull pencil makes a mark of the correct width with one stroke, however, the lines are usually not black enough to score properly every time.

For example:

Proper mark -- A 1 B 2 C 3 D 4 E 5

Improper Marks:

too light	--	A 1	B 2	C 3	D 4	E 5
too short	--	A 1	B 2	C 3	D 4	E 5
too long	--	A 1	B 2	C 3	D 4	E 5
too thick	--	A 1	B 2	C 3	D 4	E 5

In conclusion, by considering the responses of 1624 Alberta school children in grades two to nine inclusive, the author was able to set guidelines, in terms of grade level and instruction type, for the use of optically scored answer sheets. By complying with the limitations as specified, a research worker will be able to gather valid data using this technique keeping the number of systematic errors made by the students to a minimum.

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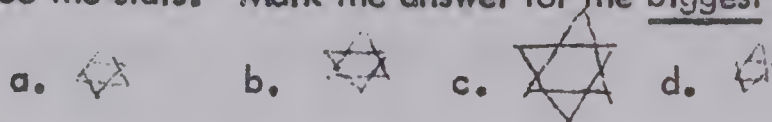
A P P E N D I X A

This appendix contains copies of the test used by grade. The questions used for the dependent variable marked with an X.

1. Look at line number 1. See the balls. Mark the answer on the answer sheet for the biggest ball.



2. Look at line number 2. See the stars. Mark the answer for the biggest star.



- X 3. Look at line 3. See the blocks. Mark the answer for the smallest block on the answer sheet.



- X 4. Look at line 4. See the moons. Mark the answer for the smallest moon on the answer sheet.



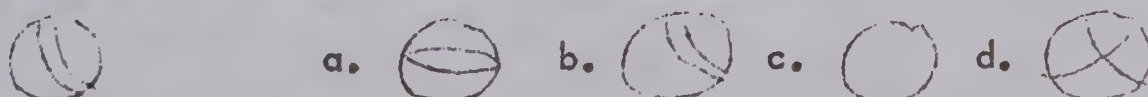
5. Look at line number 5. See the first block. Now mark the answer on the answer sheet for the other block that is just like it.



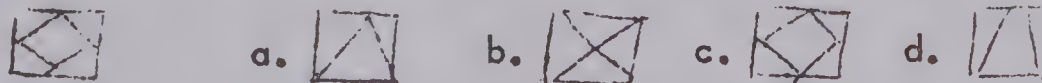
6. Look at line number 6. See the little window. Find the other window like it and mark the answer for the other window on the answer sheet.



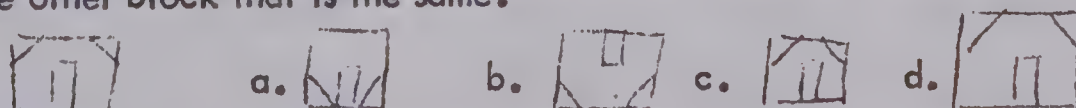
- X 7. Look at line number 7. See the first ball. Now find the other ball like it and mark the answer for that ball on the answer sheet.



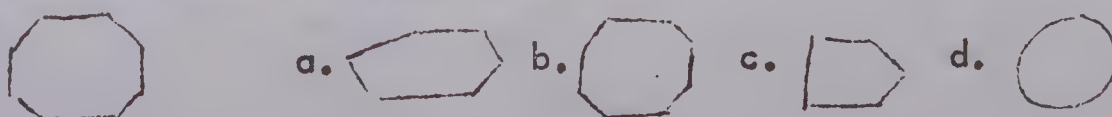
- X 8. Look at line 8. See the first block. Mark the answer on the answer sheet for the other block that is just like it.



9. Look at line 9. See the first block. Now mark the answer on the answer sheet for the other block that is the same.



10. Look at number 10. See the first figure. Mark the answer on the answer sheet for the other figure that is just like it.



For questions 11 to 19, mark the answer on the answer sheet for the word that is the opposite in meaning of the word underlined.

11. The opposite of up is : a. down b. play c. run d. see
12. The opposite of black is : a. blue b. green c. red d. white
13. The opposite of hot is : a. cold b. cool c. sun d. warm
14. The opposite of far is : a. beside b. near c. under d. up
15. The opposite of father is. : a. aunt b. mother c. sister d. uncle
16. The opposite of work is : a. fun b. games c. job d. play
17. The opposite of happy is : a. glad b. gay c. sad d. joy
18. The opposite of first is : a. end b. last c. new d. old

For questions 19 to 30, find the answer that makes the following statements TRUE.

- X 19. $1 + 1 =$ a. 0 b. 1 c. 2 d. 3
- X 20. $2 + 2 =$ a. 4 b. 5 c. 6 d. 7
- X 21. $1 + 2 =$: a. 0 b. 1 c. 2 d. 3
22. $4 + 1 =$ a. 5 b. 6 c. 7 d. 41
23. $2 + 6 =$ a. 6 b. 7 c. 8 d. 9
24. $5 + 4 =$ a. 8 b. 9 c. 10 d. 11
25. $6 + 2 =$ a. 7 b. 8 c. 9 d. 10
26. $5 - 3 =$ a. 2 b. 3 c. 4 d. 5
27. $7 - 7 =$ a. 0 b. 1 c. 2 d. 3
28. $9 - 8 =$ a. 0 b. 1 c. 2 d. 3

29. $12 - 11 =$

a. 0

b. 1

c. -2

d. -3

30. $16 - 14 =$

a. 1

b. 2

c. 3

d. 4

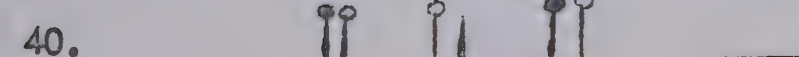
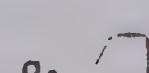
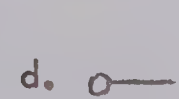
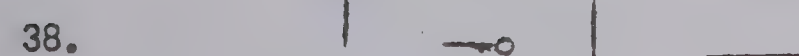
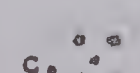
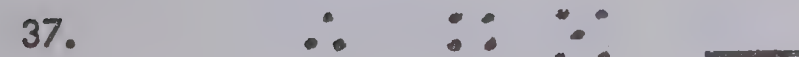
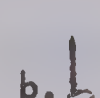
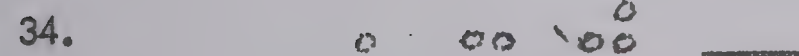
31. Look at line 31. The first three drawings in the row are alike in certain ways.
Find the drawing at the right that fits in the blank.



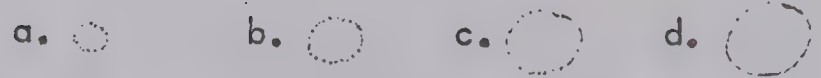
32. Look at line 32. The first three drawings in the row are alike in certain ways.
Find the drawing at the right that fits in the blank.



33. For the rest of the test, continue to answer the questions as in questions 31 and 32.
Find the drawing at the right that fits in the blank.



- X 1. Look at line number 1. See the balls. Mark the answer on the answer sheet for the biggest ball.



- X 2. Look at line number 2. See the stars. Mark the answer on the answer sheet for the biggest star.



- X 3. Look at line number 3. See the blocks. Mark the answer on the answer sheet for the smallest block.



4. Look now at line 4. See the moons. Mark the answer on the answer sheet for the smallest moon.



5. Look at line 5. See the first block. Now mark the answer on the answer sheet for the other block that is just like it.



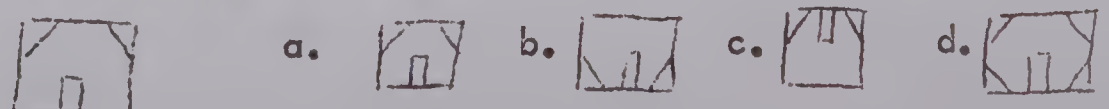
6. Look at line 6. See the little ball. Find the other ball like it and mark the answer for the other window on the answer sheet.



- X 7. Look at line 7. See the first window. Find the other window just like it and mark the answer on the answer sheet.



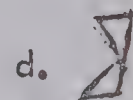
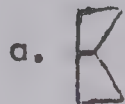
8. Look at number 8. See the block. Now find the other block just like it and mark that answer on the answer sheet.



9. For number 9 do the same.



10. For number 10 do the same.


















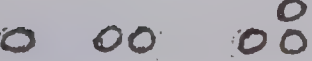














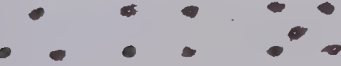









For questions 11 to 20, have the students mark the answer on the answer sheet for the word that is the opposite in meaning of the word underlined.

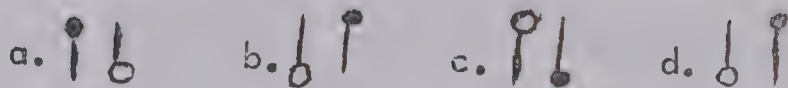
- X 11. The opposite of up is : a. down b. play c. run d. see
12. The opposite of black is : a. blue b. green c. red d. white
13. The opposite of hot is : a. cold b. cool c. sun d. warm
14. The opposite of far is : a. beside b. near c. under d. up
15. The opposite of father is : a. aunt b. mother c. sister d. uncle
16. The opposite of work is : a. fun b. games c. job d. play
17. The opposite of happy is : a. gay b. glad c. joy d. sad
18. The opposite of first is : a. end b. last c. new d. old
19. The opposite of boy is : a. brother b. girl c. uncle d. sister
20. The opposite of short is : a. bunch b. fall c. small d. tall



















For questions 21 to 30, have the students find the answer that makes the following statements TRUE.

- | | | | | | |
|-------|-------------|-------|-------|-------|-------|
| 21. | $1 + 1 =$ | a. 0 | b. 1 | c. 2 | d. 3 |
| X 22. | $2 + 2 =$ | a. 4 | b. 5 | c. 6 | d. 7 |
| X 23. | $1 + 2 =$ | a. 0 | b. 1 | c. 2 | d. 3 |
| 24. | $4 + 1 =$ | a. 4 | b. 5 | c. 6 | d. 7 |
| 25. | $2 + 6 =$ | a. 6 | b. 7 | c. 8 | d. 9 |
| 26. | $5 + 13 =$ | a. 17 | b. 18 | c. 19 | d. 20 |
| 27. | $14 + 4 =$ | a. 16 | b. 17 | c. 18 | d. 19 |
| 28. | $11 - 7 =$ | a. 3 | b. 4 | c. 5 | d. 19 |
| 29. | $7 - 7 =$ | a. 0 | b. 1 | c. 2 | d. 3 |
| 30. | $16 - 14 =$ | a. 0 | b. 1 | c. 2 | d. 3 |

For each of questions 31 to 40, the first three drawings in the row are alike in certain ways. Find the drawing at the right that fits in the blank.

- | | | | | | | |
|-----|---|-----|--|--|--|--|
| 31. |  | ___ | a.  | b.  | c.  | d.  |
| 32. |  | ___ | a.  | b.  | c.  | d.  |
| 33. |  | ___ | a.  | b.  | c.  | d.  |
| 34. |  | ___ | a.  | b.  | c.  | d.  |
| 35. |  | ___ | a.  | b.  | c.  | d.  |
| 36. |  | ___ | a.  | b.  | c.  | d.  |
| 37. |  | ___ | a.  | b.  | c.  | d.  |
| 38. |  | ___ | a.  | b.  | c.  | d.  |



1. a.  b.  c.  d. 
2. a.  b.  c.  d. 
3.  a.  b.  c.  d. 
4.  a.  b.  c.  d. 
- X 5. The opposite of up is: a. down b. play c. run d. see
6. The opposite of black is: a. blue b. green c. red d. white
- X 7. The opposite of hot is: a. cold b. cool c. sun d. warm
8. The opposite of far is: a. beside b. near c. under d. up
9. The opposite of father is: a. aunt b. mother c. sister d. uncle
- X 10. The opposite of work is: a. fun b. games c. job d. play
11. The opposite of happy is: a. gay b. glad c. joy d. sad
12. The opposite of first is: a. end b. last c. new d. old
13. The opposite of boy is: a. brother b. girl c. uncle d. sister
14. The opposite of short is: a. bunch b. fall c. small d. tall
15. The opposite of active is: a. quiet b. quilt c. quit d. quite

16. $1 + 1 =$

a. 0

b. 1

c. 2

d. 4

17. $2 + 2 =$

a. 4

b. 5

c. 6

d. 7

18. $1 + 2 =$

a. 0

b. 1

c. 2

d. 3

19. $4 + 1 =$

a. 4

b. 5

c. 6

d. 7

20. $2 + 6 =$

a. 5

b. 6

c. 7

d. 8

21. $12 + 11 =$

a. 1

b. 21

c. 22

d. 23

22. $37 \times 4 =$

a. 41

b. 128

c. 138

d. 143

23. $135 \div 5 =$

a. 25

b. 27

c. 29

d. 140

24. $17 - 7 =$

a. 7

b. 10

c. 24

d. 34

25. $30 - 16 =$

a. 4

b. 14

c. 24

d. 46

26. $503 - 261 =$

a. 142

b. 232

c. 242

d. 342

27. $17 \times 11 =$

a. 23

b. 177

c. 187

d. 287

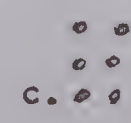
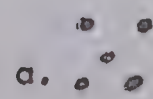
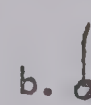
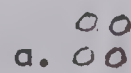
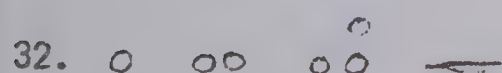
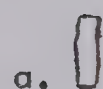
28. $45 \div 15 =$


























a. 3

b. 4

c. 30

d. 60



36.  _____ a.  b.  c.  d. 
37.  _____ a.  b.  c.  d. 
38.  _____ a.  b.  c.  d. 
39.  _____ a.  b.  c.  d. 
40.  _____ a.  b.  c.  d. 

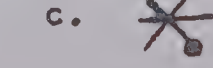
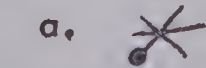
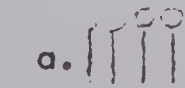
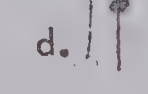
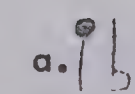
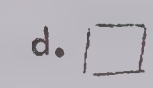
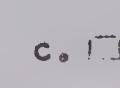
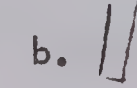
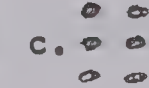
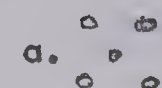
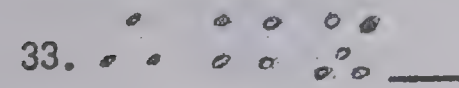
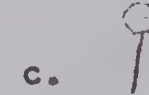
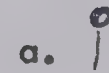
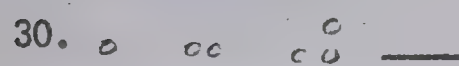
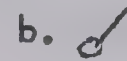
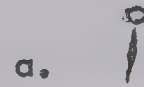
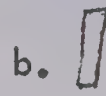
For questions 1 to 12, mark the answer on the answer sheet for the word that is the opposite in meaning of the word underlined.

1. The opposite of up is : a. down b. play c. run d. see
- X 2. The opposite of black is : a. blue b. green c. red d. white
3. The opposite of hot is : a. cold b. cool c. sun d. warm
- X 4. The opposite of far is : a. beside b. near c. under d. up
5. The opposite of father is : a. aunt b. mother c. sister d. uncle
6. The opposite of since is : a. become b. beggar c. before d. beneath
7. The opposite of active is : a. quiet b. quilt c. quit d. quite
- X 8. The opposite of boy is : a. brother b. girl c. uncle d. sister
9. The opposite of work is : a. fun b. games c. job d. play
10. The opposite of deep is : a. dodge b. drank c. empty d. shallow
11. The opposite of attic is : a. basement b. roof c. room d. wire
12. The opposite of future is : a. farther b. further c. past d. patent

For each of questions 13 to 26, find the answer that makes the following statement TRUE:

- | | | | | | |
|-------|------------------------------------|-------------------|--------------------|--------------------|--------------------|
| X 13. | $1 + 1 =$ | a. 0 | b. 1 | c. 2 | d. 3 |
| X 14. | $2 + 2 =$ | a. 4 | b. 5 | c. 6 | d. 7 |
| X 15. | $1 + 2 =$ | a. 0 | b. 1 | c. 2 | d. 3 |
| | 16. $4 + 1 =$ | a. 4 | b. 5 | c. 6 | d. 7 |
| X 17. | $2 + 6 =$ | a. 5 | b. 6 | c. 7 | d. 8 |
| | 18. $12 \div 11 =$ | a. 1 | b. 21 | c. 22 | d. 23 |
| | 19. $37 \times 4 =$ | a. 41 | b. 128 | c. 138 | d. 148 |
| | 20. $135 \div 5 =$ | a. 25 | b. 27 | c. 29 | d. 140 |
| | 21. $17 - 7 =$ | a. 7 | b. 10 | c. 24 | d. 34 |
| | 22. $30 - 16 =$ | a. 4 | b. 14 | c. 24 | d. 46 |
| | 23. $503 - 261 =$ | a. 142 | b. 232 | c. 242 | d. 342 |
| | 24. $17 \times 11 =$ | a. 28 | b. 177 | c. 187 | d. 287 |
| | 25. $\frac{5}{8} - \frac{1}{8} =$ | a. $\frac{4}{8}$ | b. $\frac{2}{13}$ | c. $\frac{4}{8}$ | d. $\frac{6}{8}$ |
| | 26. $\frac{4}{5} + \frac{1}{20} =$ | a. $\frac{5}{25}$ | b. $\frac{17}{40}$ | c. $\frac{17}{20}$ | d. $\frac{21}{20}$ |

For each of questions 27 to 40, the first three drawings in the row are alike in certain ways. Find the drawing at the right that fits in the blank.



GRADE 6

For questions 1 to 11, mark the answer on the answer sheet for the word that is the opposite in meaning of the word that is underlined.

1. The opposite of up is : a. down b. play c. run d. see
- X 2. The opposite of black is : a. blue b. green c. red d. white
- X 3. The opposite of hot is : a. cold b. cool c. sun d. warm
- X 4. The opposite of far is : a. beside b. near c. under d. up
5. The opposite of father is : a. aunt b. mother c. sister d. uncle
6. The opposite of since is : a. become b. beggar c. before d. beneath
7. The opposite of active is : a. quiet b. quilt c. quit d. quite
8. The opposite of attic is : a. basement b. fool c. roof d. wise
9. The opposite of work is : a. fun b. games c. job d. play
10. The opposite of future is : a. farther b. further c. past d. patent
11. The opposite of prosperity is: a. poultry b. poverty c. priority d. property

For each of questions 12 to 25, find the answer that makes the following TRUE and mark that answer on the answer sheet.

12. $1 + 1 =$ a. 0 b. 1 c. 2 d. 3

X 13. $2 + 2 =$ a. 4 b. 5 c. 6 d. 7

14. $1 + 2 =$ a. 0 b. 1 c. 2 d. 3

X 15. $1 + 4 =$ a. 4 b. 5 c. 6 d. 7

X 16. $18 + 11 =$ a. 27 b. 29 c. 31 d. 36

X 17. $528 + 72 =$ a. 600 b. 605 c. 700 d. 800

18. $473 - 26 =$ a. 447 b. 457 c. 467 d. 477

19. $50 \times 44 =$ a. 2200 b. 2300 c. 2400 d. 2500

20. $6 \times 807 =$ a. 4742 b. 4842 c. 4942 d. 4952

21. $\frac{5}{6} - \frac{1}{6} =$ a. $\frac{1}{6}$ b. $\frac{2}{6}$ c. $\frac{3}{6}$ d. $\frac{4}{6}$















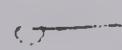




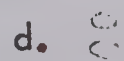















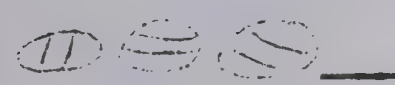























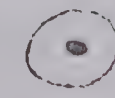





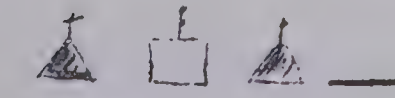









22. $\frac{4}{5} + \frac{1}{20} =$ a. $\frac{17}{20}$ b. $\frac{18}{20}$ c. $\frac{1}{5}$ d. $\frac{2}{5}$

23. $4\frac{1}{2} - 3\frac{5}{6} =$ a. $\frac{4}{6}$ b. $\frac{7}{6}$ c. $\frac{16}{6}$ d. $\frac{60}{6}$

24. $3\frac{1}{2} \times \frac{1}{5} =$ a. $\frac{7}{10}$ b. $\frac{8}{10}$ c. $\frac{13}{2}$ d. $\frac{35}{2}$

25. $\frac{5}{6} \times \frac{3}{10} =$ a. $\frac{8}{60}$ b. $\frac{15}{60}$ c. $\frac{8}{16}$ d. $\frac{15}{16}$

For each of the question 26 to 40, the first three drawings in the row are alike in certain ways. Find the drawing at the right that fits in the blank.

26.  a.  b.  c.  d. 
27.  a.  b.  c.  d. 
28.  a.  b.  c.  d. 
29.  a.  b.  c.  d. 
30.  a.  b.  c.  d. 
31.  a.  b.  c.  d. 
32.  a.  b.  c.  d. 
33.  a.  b.  c.  d. 
34.  a.  b.  c.  d. 
35.  a.  b.  c.  d. 
36.  a.  b.  c.  d. 
37.  a.  b.  c.  d. 
38.  a.  b.  c.  d. 
39.  a.  b.  c.  d. 
40.  a.  b.  c.  d. 




















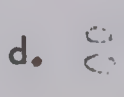













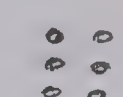









































For questions 1 to 11, mark the answer on the answer sheet for the word that is the opposite in meaning of the word that is underlined.

1. The opposite of up is : a. down b. play c. run d. see
- X 2. The opposite of black is : a. blue b. green c. red d. white
- X 3. The opposite of hot is : a. cold b. cool c. sun d. warm
- X 4. The opposite of far is : a. beside b. near c. under d. up
5. The opposite of active is : a. quiet b. quilt c. quit d. quite
6. The opposite of work is : a. fun b. games c. job d. play
7. The opposite of since is : a. become b. beggar c. before d. beneath
8. The opposite of destruction is: a. constellation b. constitution c. construction
d. conversation
9. The opposite of prosperity is: a. priority b. property c. poultry d. poverty
- X 10. The opposite of nervous is : a. calm b. normal c. nylon d. weird
11. The opposite of comedy is : a. musical b. parody c. satire d. tragedy

For each of the questions 12 to 25, find the answer that makes the following TRUE and mark that answer on the answer sheet.

- | | | | | |
|---|-------------------|--------------------|--------------------|--------------------|
| 12. $1 + 1 =$ | a. 0 | b. 1 | c. 2 | d. 3 |
| 13. $2 + 2 =$ | a. 4 | b. 5 | c. 6 | d. 7 |
| X 14. $1 + 2 =$ | a. 0 | b. 1 | c. 2 | d. 3 |
| X 15. $1 + 4 =$ | a. 4 | b. 5 | c. 6 | d. 7 |
| X 16. $528 + 72 =$ | a. 600 | b. 605 | c. 700 | d. 800 |
| 17. $473 - 26 =$ | a. 447 | b. 457 | c. 467 | d. 477 |
| 18. $50 \times 44 =$ | a. 2200 | b. 2300 | c. 2400 | d. 2500 |
| 19. $\frac{4}{5} + \frac{1}{20} =$ | a. $\frac{1}{5}$ | b. $\frac{2}{5}$ | c. $\frac{17}{20}$ | d. $\frac{18}{20}$ |
| 20. $4\frac{1}{2} - 3\frac{5}{6} =$ | a. $\frac{4}{6}$ | b. $\frac{7}{6}$ | c. $\frac{16}{6}$ | d. $\frac{50}{6}$ |
| 21. $\frac{5}{6} \times \frac{3}{10} =$ | a. $\frac{8}{60}$ | b. $\frac{15}{60}$ | c. $\frac{8}{16}$ | d. $\frac{15}{16}$ |
| 22. $\frac{3}{8} \div \frac{1}{4} =$ | a. $\frac{3}{32}$ | b. $\frac{3}{12}$ | c. $\frac{4}{12}$ | d. $\frac{3}{2}$ |
| 23. $.862 - .372 =$ | a. .490 | b. .590 | c. 490 | d. 590 |
| 24. $4\frac{1}{2} \times \frac{2}{3} =$ | a. 3 | b. $\frac{11}{6}$ | c. $\frac{7}{5}$ | d. $\frac{18}{5}$ |
| 25. $2^4 =$ | a. 4 | b. 8 | c. 16 | d. 32 |

For each of the question 26 to 40, the first three drawings in the row are alike in certain ways. Find the drawing at the right that fits in the blank.

26.  — a.  b.  c.  d. 
27.  — a.  b.  c.  d. 
28.  — a.  b.  c.  d. 
29.  — a.  b.  c.  d. 
30.  — a.  b.  c.  d. 
31.  — a.  b.  c.  d. 
32.  — a.  b.  c.  d. 
33.  — a.  b.  c.  d. 
34.  — a.  b.  c.  d. 
35.  — a.  b.  c.  d. 
36.  — a.  b.  c.  d. 
37.  — a.  b.  c.  d. 
38.  — a.  b.  c.  d. 
39.  — a.  b.  c.  d. 
40.  — a.  b.  c.  d. 

GRADE 8
















































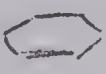


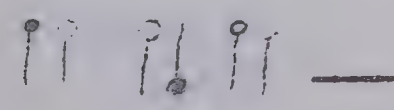









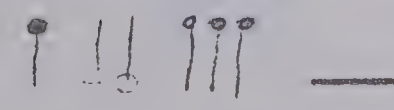














For questions 1 to 11, mark the answer on the answer sheet for the word that is the opposite in meaning of the word that is underlined.

1. The opposite of up is : a. down b. play c. run d. see
- X 2. The opposite of black is : a. blue b. green c. red d. white
- X 3. The opposite of hot is : a. cold b. cool c. sun d. warm
- X 4. The opposite of far is : a. beside b. near c. under d. up
5. The opposite of work is : a. fun b. games c. job d. play
6. The opposite of active is : a. quiet b. quilt c. quit d. quite
7. The opposite of prosperity is: a. priority b. property c. poultry d. poverty
- X 8. The opposite of nervous is : a. calm b. normal c. nylon d. weird
9. The opposite of comedy is : a. musical b. parody c. satire d. tragedy
10. The opposite of destruction is: a. constellation b. constitution c. construction
d. conversation
11. The opposite of feminine is : a. marvellous b. masculine c. merciful d. merely

For each of the questions 12 to 25, find the answer that makes the following TRUE and mark that answer on the answer sheet.

- | | | | | |
|---|-------------------|--------------------|--------------------|--------------------|
| X 12. $1 + 1 =$ | a. 0 | b. 1 | c. 2 | d. 3 |
| 13. $2 + 2 =$ | a. 4 | b. 5 | c. 6 | d. 7 |
| X 14. $1 + 2 =$ | a. 0 | b. 1 | c. 2 | d. 3 |
| 15. $1 + 4 =$ | a. 4 | b. 5 | c. 6 | d. 7 |
| X 16. $528 + 72 =$ | a. 600 | b. 605 | c. 700 | d. 800 |
| 17. $473 - 26 =$ | a. 447 | b. 457 | c. 439 | d. 499 |
| 18. $\frac{5}{6} \times \frac{3}{10} =$ | a. $\frac{8}{60}$ | b. $\frac{15}{60}$ | c. $\frac{8}{16}$ | d. $\frac{15}{16}$ |
| 19. $\frac{3}{8} \div \frac{1}{4} =$ | a. $\frac{3}{32}$ | b. $\frac{3}{12}$ | c. $\frac{4}{12}$ | d. $\frac{3}{2}$ |
| 20. $4\frac{1}{2} - 3\frac{5}{6} =$ | a. $\frac{4}{6}$ | b. $\frac{7}{6}$ | c. $\frac{16}{6}$ | d. $\frac{50}{6}$ |
| 21. $.862 - .372 =$ | a. .490 | b. .590 | c. 490 | d. 590 |
| 22. $4\frac{1}{2} \times \frac{2}{3} =$ | a. 3 | b. $\frac{7}{5}$ | c. $\frac{11}{6}$ | d. $\frac{18}{5}$ |
| 23. $2^4 =$ | a. 16 | b. 32 | c. 64 | d. 128 |
| 24. $\left(\frac{7}{4}\right)^2 =$ | a. $\frac{7}{16}$ | b. $\frac{14}{18}$ | c. $\frac{49}{16}$ | d. $\frac{49}{4}$ |
| 25. $4^1 =$ | a. 1 | b. 4 | c. 5 | d. 8 |

For each of the question 26 to 40, the first three drawings in the row are alike in certain ways. Find the drawing at the right that fits in the blank.

26.  — a.  b.  c.  d. 
27.  — a.  b.  c.  d. 
28.  — a.  b.  c.  d. 
29.  — a.  b.  c.  d. 
30.  — a.  b.  c.  d. 
31.  — a.  b.  c.  d. 
32.  — a.  b.  c.  d. 
33.  — a.  b.  c.  d. 
34.  — a.  b.  c.  d. 
35.  — a.  b.  c.  d. 
36.  — a.  b.  c.  d. 
37.  — a.  b.  c.  d. 
38.  — a.  b.  c.  d. 
39.  — a.  b.  c.  d. 
40.  — a.  b.  c.  d. 

GRADE 9

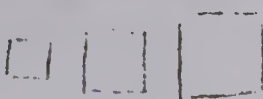










































































For questions 1 to 11, mark the answer on the answer sheet for the word that is the opposite in meaning of the word that is underlined.

1. The opposite of
up is: a. down b. play c. run d. see
- X 2. The opposite of
black is: a. blue b. green c. red d. white
- X 3. The opposite of
hot is: a. cold b. cool c. sun d. warm
4. The opposite of
far is: a. beside b. near c. under d. up
5. The opposite of
work is: a. fun b. games c. job d. play
6. The opposite of
active is: a. quiet b. quilt c. quit d. quite
7. The opposite of
prosperity is: a. priority b. property c. poultry d. poverty
- X 8. The opposite of
comedy is: a. musical b. parody c. satire d. tragedy
9. The opposite of
destruction is: a. constellation b. constitution c. construction
d. conversation
- X 10. The opposite of
feminine is: a. marvellous b. masculine c. merciful
d. merely
11. The opposite of
dessert is: a. abandon b. grassland c. hold d. soup

For each of the questions 12 to 25, find the answer that makes the following TRUE and mark that answer on the answer sheet:

- X 12. $1 + 1 =$ a. 0 b. 1 c. 2 d. 3
13. $2 + 2 =$ a. 4 b. 5 c. 6 d. 7
14. $1 + 2 =$ a. 0 b. 1 c. 2 d. 3
- X 15. $1 + 4 =$ a. 4 b. 5 c. 6 d. 7
- X 16. $528 + 72 =$ a. 600 b. ~~605~~ c. 700 d. 800
17. $\frac{5}{6} \times \frac{3}{10} =$ a. $\frac{8}{60}$ b. $\frac{15}{60}$ c. $\frac{8}{16}$ d. $\frac{15}{16}$
18. $\frac{3}{8} \div \frac{1}{4} =$ a. $\frac{3}{32}$ b. $\frac{3}{12}$ c. $\frac{4}{12}$ d. $\frac{3}{2}$
19. $.862 - .372 =$ a. .490 b. .590 c. 490 d. 590
20. $4\frac{1}{2} \times \frac{2}{3} =$ a. 3 b. $\frac{7}{5}$ c. $\frac{11}{6}$ d. $\frac{18}{5}$
21. $2^4 =$ a. 16 b. 32 c. 64 d. 128
22. $\left(\frac{7}{4}\right)^2 =$ a. $\frac{7}{16}$ b. $\frac{14}{18}$ c. $\frac{49}{16}$ d. $\frac{49}{4}$
23. $4^1 =$ a. 1 b. 4 c. 6 d. 8
24. $5\frac{5}{8} - 15 - 2\frac{1}{2} =$ a. $\frac{95}{8}$ b. $-\frac{95}{8}$ c. 3.3 d. -3.3
25. $\left(7\frac{1}{2} \times 0\right) + 6 =$ a. 6 b. $7\frac{1}{2}$ c. $13\frac{1}{2}$ d. 45

For each of the question 26 to 40, the first three drawings in the row are alike in certain ways. Find the drawing at the right that fits in the blank.

26.  — a.  b.  c.  d. 
27.  — a.  b.  c.  d. 
28.  — a.  b.  c.  d. 
29.  — a.  b.  c.  d. 
30.  — a.  b.  c.  d. 
31.  — a.  b.  c.  d. 
32.  — a.  b.  c.  d. 
33.  — a.  b.  c.  d. 
34.  — a.  b.  c.  d. 
35.  — a.  b.  c.  d. 
36.  — a.  b.  c.  d. 
37.  — a.  b.  c.  d. 
38.  — a.  b.  c.  d. 
39.  — a.  b.  c.  d. 
40.  — a.  b.  c.  d. 

A P P E N D I X B

SCHOOL

GRADE

STUDENT NUMBER

Indicate answer by placing a mark between the guidelines as shown in the example. Use HB pencil.

Example

A 1 B 2 C 3 D 4 E 5

MALE

FEMALE

(Yrs.)

ART 1

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ART 2

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A P P E N D I X C

(Instruction Set 2)

A Study of Students' Abilities.

Instructions for the Test:

- (1) We wish to find out how well you are able to do certain kinds of problems. We ask, therefore, that you do this test.
- (2) Each question is worth one mark.
- (3) Work quickly. Please do not leave out any questions.
- (4) Mark the space on the answer sheet for each of your answers.
- (5) Do all forty questions. But if you find a question you are unable to answer, leave it and return to it if you have time at the end of the exam.
- (6) Fill in, at the top of the answer sheet, your:
 - (a) Name
 - (b) Grade
 - (c) Class or Teacher's name.
- (7) An example is given below:
 $4 + 4 =$ (a) 7 (b) 8 (c) 9 (d) 10
(b) is the correct answer. Now see how this example is marked on the answer sheet.

Do Not Write in This Booklet, Please.

A P P E N D I X D

(Instruction Set 3)

A Study of Students' Abilities.









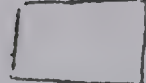
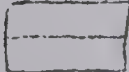



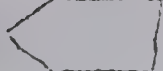















Instructions for the Test:









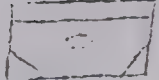











- (1) We wish to find out how well you are able to do certain kinds of problems. We ask, therefore, that you do this test.
- (2) Each question is worth one mark.
- (3) Do not make the marks for the answers larger than the spaces between the red lines.
- (4) Mark only one answer for each question.
- (5) To change an answer erase your first answer completely.
- (6) Use a sharp H.B. pencil only (medium soft)
- (7) Do not make any marks in the black lines along the side of the answer sheet.
- (8) Do not fold or bend your answer sheet.
- (9) Do all forty questions. But if you find a question you are unable to answer, leave it and return to it if you have time at the end of the exam.
- (10) A sample question is given below:
 $4 + 4 =$ (a) 7 (b) 8 (c) 9 (d) 10
(b) is the correct answer. See how this answer is marked on the answer sheet.
- (11) At the top of your answer sheet, fill in your:
 - (a) Name
 - (b) Grade
 - (c) Class or teacher's name.

Please do not write in this test booklet.

A P P E N D I X E

PRACTICE TEST FOR GRADES 2 & 3

1. a.  b.  c.  d. 
2. a.  b.  c.  d. 
3.  a.  b.  c.  d. 
4.  a.  b.  c.  d. 
5.    — a.  b.  c.  d. 
6. I II III — a.  b.  c.  d. 
7. $2 + 3 =$ a. 3 b. 4 c. 5 d. 6
8. $4 + 2 =$ a. 6 b. 7 c. 8 d. 9
9. The opposite of old is: a. new b. my c. make d. first
10. The opposite of up is: a. see b. run c. play d. down

1. 
 - a. 
 - b. 
 - c. 
 - d. 
2. 
 - a. 
 - b. 
 - c. 
 - d. 
3. 
 - a. 
 - b. 
 - c. 
 - d. 
4. 
 - a. 
 - b. 
 - c. 
 - d. 
5. $7 \times 12 =$
 - a. 19
 - b. 74
 - c. 84
 - d. 94
6. $125 \times 5 =$
 - a. 5
 - b. 25
 - c. 325
 - d. 625
7. The opposite of buy is:
 - a. bough
 - b. box
 - c. girl
 - d. sell
8. The opposite of fix is:
 - a. brake
 - b. break
 - c. broke
 - d. repair

PRACTICE TEST FOR GRADES 6 & 7

1.    _____ a.  b.  c.  d. 

2.    _____ a.  b.  c.  d. 

3. $12 + 17 =$ a. 5 b. 28 c. 29 d. 39

4. $476 - 249 =$ a. 127 b. 227 c. 237 d. 725

5. The opposite of least is: a. less b. more c. most d. much

6. The opposite of victory is: a. defeat b. defence c. defend d. descent

PRACTICE TEST FOR GRADES 8 & 9

1.    — a.  b.  c.  d. 

2.    — a.  b.  c.  d. 

3. $649 - 362 =$ a. 267 b. 287 c. 367 d. 387

4. $\frac{1}{4} \times \frac{4}{5} =$ a. $\frac{1}{4}$ b. $\frac{1}{5}$ c. $\frac{5}{9}$ d. $\frac{21}{20}$

5. The opposite of victory is: a. defeat b. defence c. defend d. descend

6. The opposite of majority is: a. nationality b. neutrality c. minority d. municipality

A P P E N D I X F

This appendix contains a copy of:

	Page
(1) Instructions for Practice Test	104
(2) Instructions used in treatment A	105
(3) Instructions to Administrators	106
(4) Administrators' Instructions for Grade 2	107
(5) Administrators' Instructions for Grade 3	108
(6) Administrators' Instructions for Grade 4	109

INSTRUCTIONS FOR PRACTICE TEST

To help you understand how to answer the test exercise, a practice test will be given. In the test that you are about to take, the answers are to be made on a separate answer sheet. There is a row of answer spaces numbered to match each test question.

To make an answer, first decide which is the best answer. Find the set of the answer spaces numbered the same as the question on the answer sheet. Then make a black mark in the answer space for the answer you have chosen.

There are three important things to remember:

- (1) Make a heavy mark within the red lines.
- (2) Make only ONE mark for each question.
- (3) Erase any wrong answers completely.

A Study of Students' Abilities.

Instructions for the Test:

- (1) We wish to find out how well you are able to do certain kinds of problems. We ask you, therefore, to do this test.
- (2) Each question is worth one mark.
- (3) Do all forty questions. But if you find a question you are unable to answer, leave it and return to it if you have time at the end of the exam.
- (4) Now please fill in:
 - (a) Your name: _____
 - (b) Your grade: _____
 - (c) Your class: _____
- (5) Answer by putting an X through the correct answer.
Example: $4 + 4 =$ (a) 7 (b) ~~X~~ (c) 9 (d) 10

Instructions to Administrators:

It is essential that any teacher who is to administer the test entitled "A Study of Students' Abilities" read these instructions.

Purpose:

The test is in the form of a multiple choice exam, which is frequently used to evaluate the abilities of pupils. The purpose here, is not to measure directly the students' abilities per se but rather to see how well the students are able to use an optically scored answer sheet. The value of the results could be jeopardized if the instructions are not followed carefully.

Administrative Procedure for the Test:

Make certain that each pupil has:

- (a) A sharp H.B. pencil (medium soft)
- (b) A test booklet
- (c) A piece of scrap paper on which to do rough work.

Then ask the students to read, with you, the "Instructions for the Test".

For grades 5 to 9, then allow the students to complete the test.

For grades 2 to 4, see enclosed administrators instructions for the exam.

Grade 2 Administrators Instructions:

For each of questions 1 to 30 inclusive, read each question and answer set to the students allowing time for the students to respond. If the students have difficulty with a particular question tell them to leave it blank and return to it later if they have time.

Do question number 31 as an example. After reading the instructions for the question to the students, point out that there is a set of three boxes each just a little larger than the one before it. Point out that (c) is the correct answer because it is the box that would fit in the blank to complete the set of boxes.

For questions 32 and 33, read the instructions as given and then instruct the students to do questions 34 to 40 on their own like the last three questions. Remind the students to go back and do any questions they left out if they have any time at the end of the test.

Grade 3 Administrators Instructions:

For each of questions 1 to 30 inclusive, read each question and answer set to the students allowing time for them to respond. If the students have difficulty with a particular question tell them to leave it blank and return to it if they have time at the end of the test.

Do question number 31 as an example. After reading the instructions for the question to the students, point out there is a set of three boxes each just a little larger than the one before it. Point out that (a) is the correct answer because it is the box that would fit in the blank to complete the set of boxes.

For questions 32 and 33, reread the instructions as given and then instruct the students to do questions 34 to 40 on their own like the last three. Remind them to go back and do any questions they may have left out if they have any time at the end of the test.

Grade 4 Administrators Instructions:

For questions 1 to 4, read the following instructions:

- (1) Mark the answer for the smallest ball.
- (2) Mark the answer for the largest box.
- (3) Mark the answer for the figure at the right a, b, c or d, that is the same as the figure at the left.
- (4) Mark the answer for the figure at the right a, b, c or d, that is the same as the figure at the left.

For questions 5 to 15, instruct the students to mark the answer for the word that is the opposite in meaning of the word that is underlined. Allow about 7 minutes for the students to complete this set of questions. If the students have difficulty with a particular question, tell them to leave it blank and return to it later if they have time.

For questions 16 to 28, have the students find the answer that makes the following statements true. Again allow about 7 minutes to complete the set of questions.

Do question 29 as an example. The instructions read: The first three drawings in the row are alike in certain ways. Find the drawing at the right that fits in the blank to complete the set. Point out that there is a set of three boxes each just a little larger than the one before it. Point out that (c) is the correct answer because it is the box that would fit in the blank to complete the set of boxes.

For questions 30 to 40, instruct the students to find the figure at the right a, b, c or d, that fits in the blank to complete the set. Allow a further 7 minutes for the students to complete the test on their own. Remind the students to go back and do any questions they left out if they have any time at the end of the test.

A P P E N D I X G

INSTRUCTIONS TO USERS OF IBM-1230 MACHINE SCORED ANSWER SHEETS

It is very important that answer sheets to be scored on an IBM-1230 scoring machine be marked very carefully. Because the scoring mechanism is very sensitive, students who try to "fool" the machine or who make marks incorrectly may cause the machine to score their paper incorrectly.

If the instructions given below are followed by the students, there should be no errors in scoring their answer sheets:

- (1) Use a sharp HB pencil, only, for marking answers.

DO NOT USE - (a) an IBM Electrographic Pencil;
(b) an H, 2H, 3H, etc., pencil;
(c) a pen.

- (2) When indicating answers, blacken the entire space between the guidelines corresponding to each choice. DO NOT MAKE A MARK LONGER THAN THE GUIDELINES. (See examples below). While the scoring machine has considerable tolerance with respect to marks that are too long, too short or too light, carelessly made marks increase the chances of a question being marked wrong by the machine. The most satisfactory marks are made by using a sharp pencil and stroking over the guideline two or three times. A dull pencil makes a mark of the correct width with one stroke, however, the lines are usually not black enough to score properly every time.
- (3) Be careful not to place any marks of any kind among the timing lines (the black lines in the right-hand margin of the answer sheet). Watch particularly so as not to run the personal information such as the name of the school and the name of the test into the timing marks, nor extend the answers past the guidelines in the last column of answers adjacent to the timing marks.
- (4) DO NOT MARK MORE THAN ONE ANSWER TO EACH QUESTION. The machine will score as wrong any question with more than one answer indicated. Stray pencil marks, smudges or even dots on the guidelines might also be interpreted by the machine as "double-answers" and cause an item to be marked wrong.

- (5) If you change your mind about an answer, erase the unwanted answer completely. Poor or smudged erasures may be read by the machine. Old erasers that have hardened are often a cause of smudges.
- (6) DO NOT FOLD AN ANSWER SHEET NOR BEND ANY OF THE CORNERS.

Below are examples showing a proper mark and several improper marks:

PROPER MARK:	A 1	B 2	C 3	D 4	E 5
too light	1 A 1	B 2	C 3	D 4	E 5
too short	2 A 1	B 2	C 3	D 4	E 5
too long	3 A 1	B 2	C 3	D 4	E 5
too thin	4 A 1	B 2	C 3	D 4	E 5
wrong	A 1	B 2	C 3	D 4	E 5
wrong	A 1	B 2	C 3	D 4	E 5
wrong	A 1	B 2	C 3	D 4	E 5

A P P E N D I X H

A STUDY OF PUPILS' CONCEPTS



Instructions for filling in the forms

We wish to find out how you feel about school and some school subjects. We ask you, therefore, to fill in the 7 sheets that go with these instructions.

At the top of each sheet is a title word, such as the name of a school subject. Please tell us how you feel about the title word by placing a mark between each of the 24 pairs of words that follow it.

You can see that each pair of words is a set of opposites. You can therefore tell us how you feel by looking at the two words, then marking the space between the two that correspond to your answer. An example is shown below:

Title Word - MUSIC

easy  == == == == hard
boring == ==  == == interesting

A person who feels that music is very easy, and neither interesting nor boring, would mark the spaces as shown.

If you are not taking the subject listed as the title word, leave that page blank.

Work quickly. It is better to give your first feelings rather than to think hard about each pair of words. Please do not leave out any of the pairs.

Your marks will be read by a machine, so feel free to tell how you really feel.

Do not fill in any of the blanks at the top of the sheet until after you have completed the questionnaire. Your teacher will then give instructions as to what information is to be given.

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